MiHpt

Membrane Interface Probe

+

Hydraulic Profiling Tool

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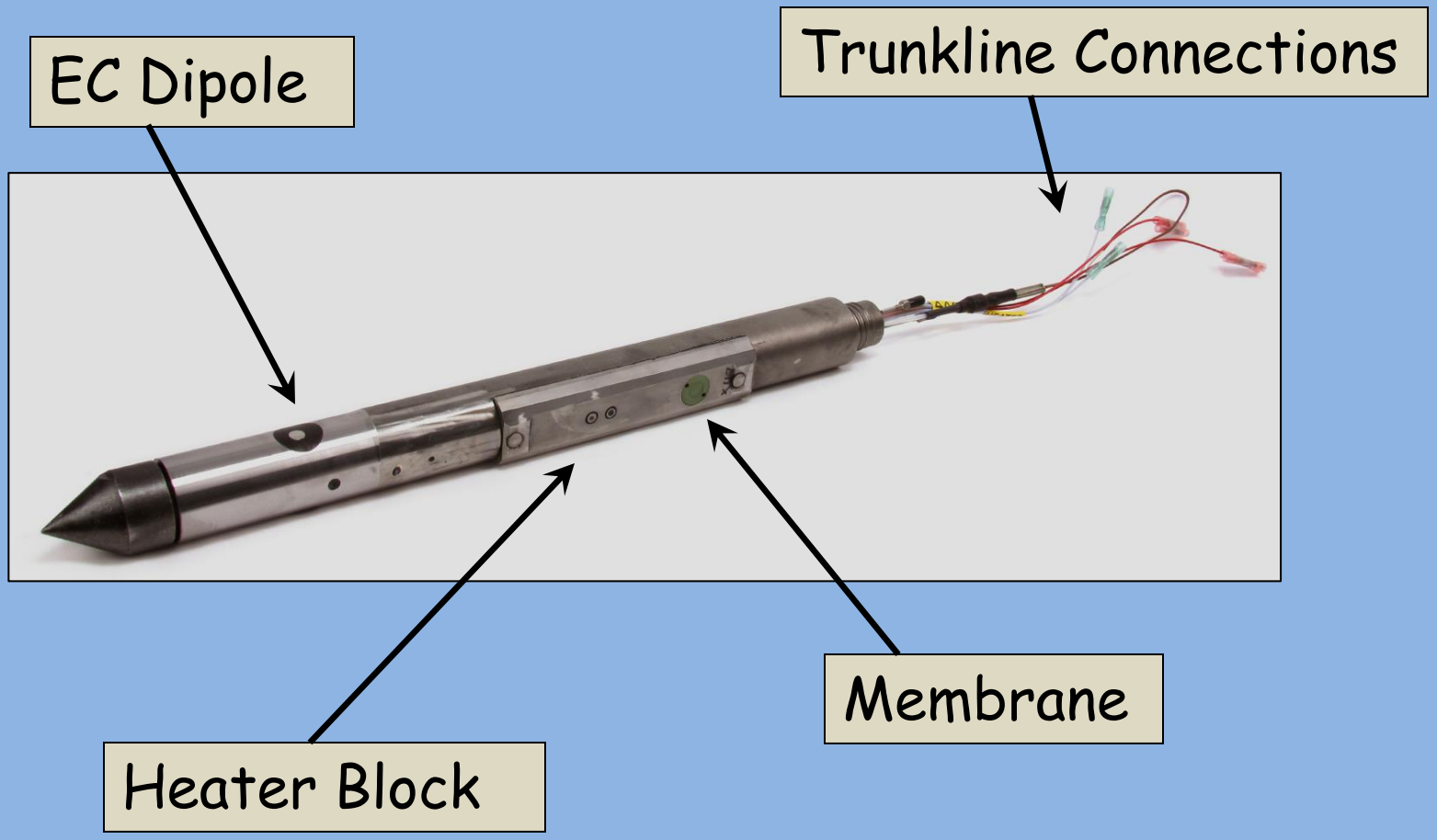
Danish Capital Region

Outline

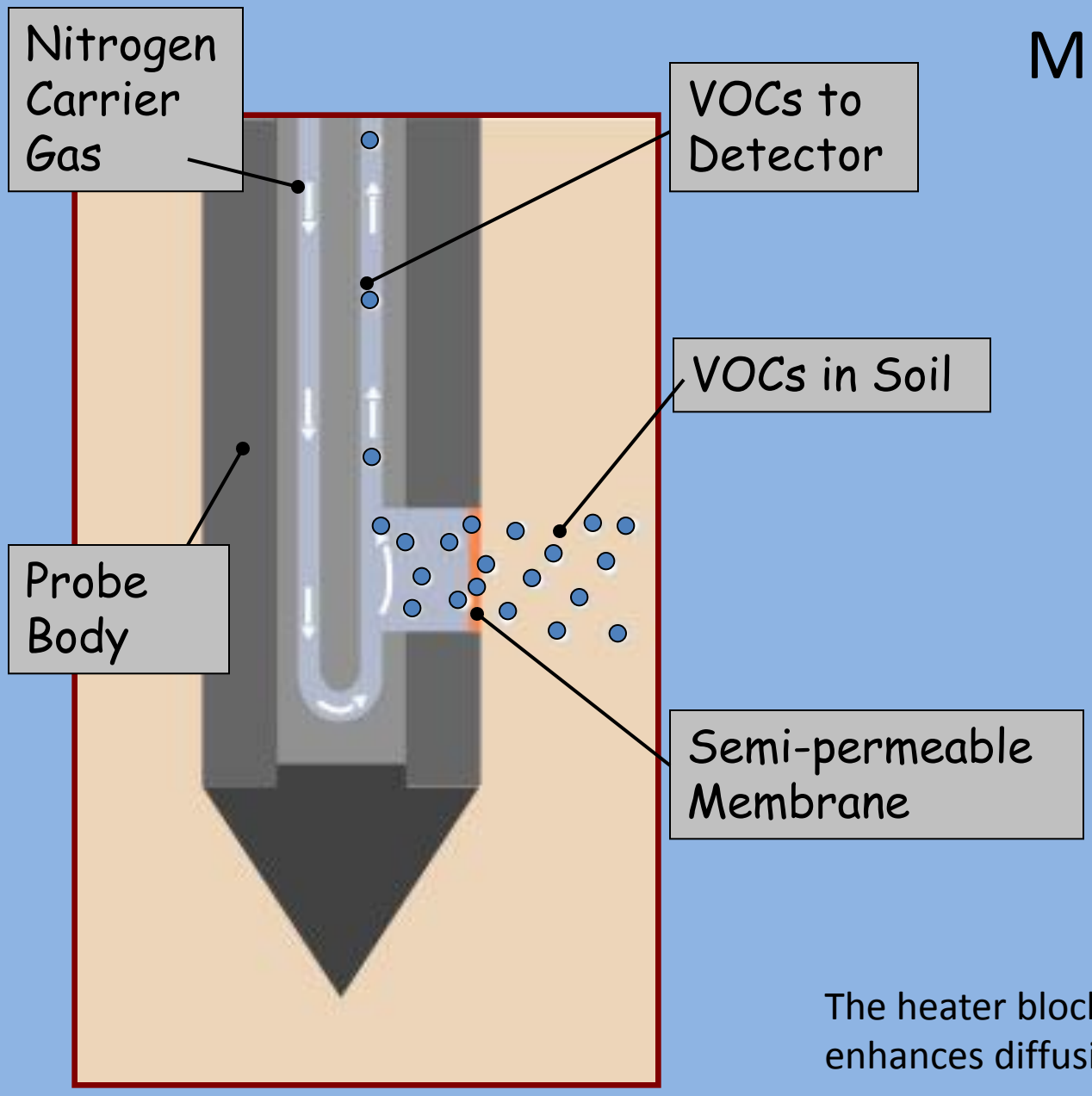
- How Does MIP Work ? MIP Log
- How Does HPT Work? HPT Log
- The Combined MiHpt Probe & Log
- Cross Sections with MiHpt logs
- Developing a Conceptual Site Model

Geoprobe®-DI

The MIP Probe



MIP Principles of Operation:

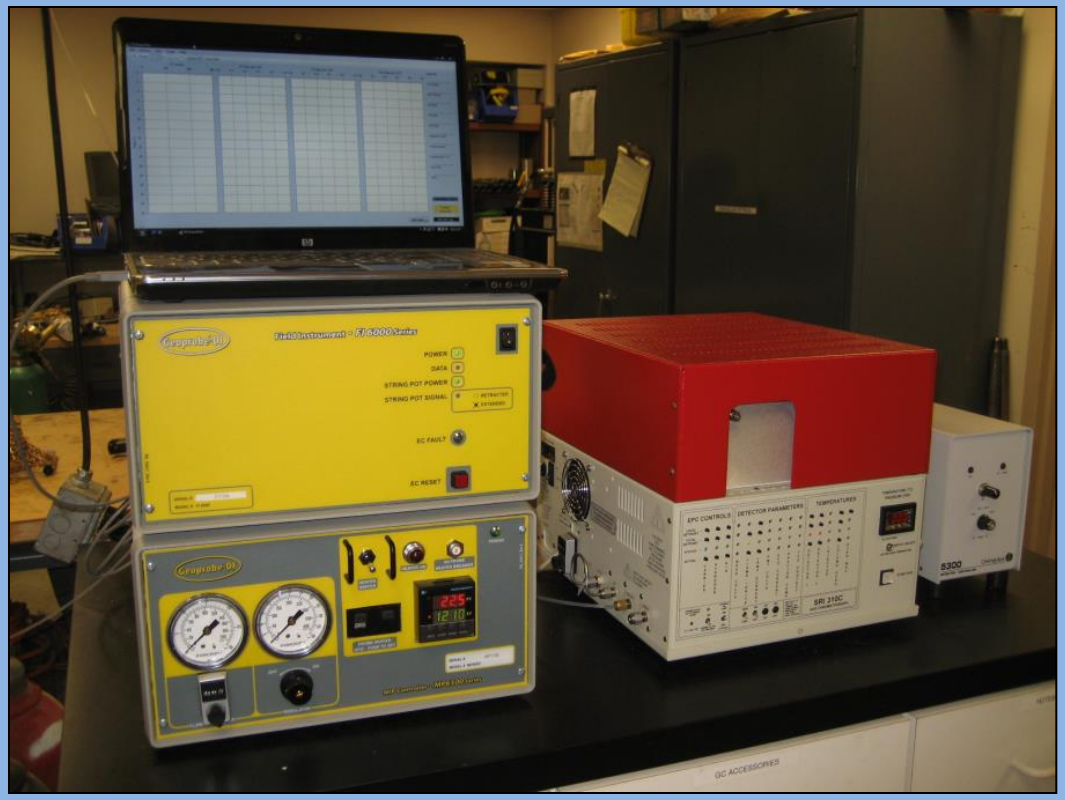


VOCs diffuse under concentration gradient

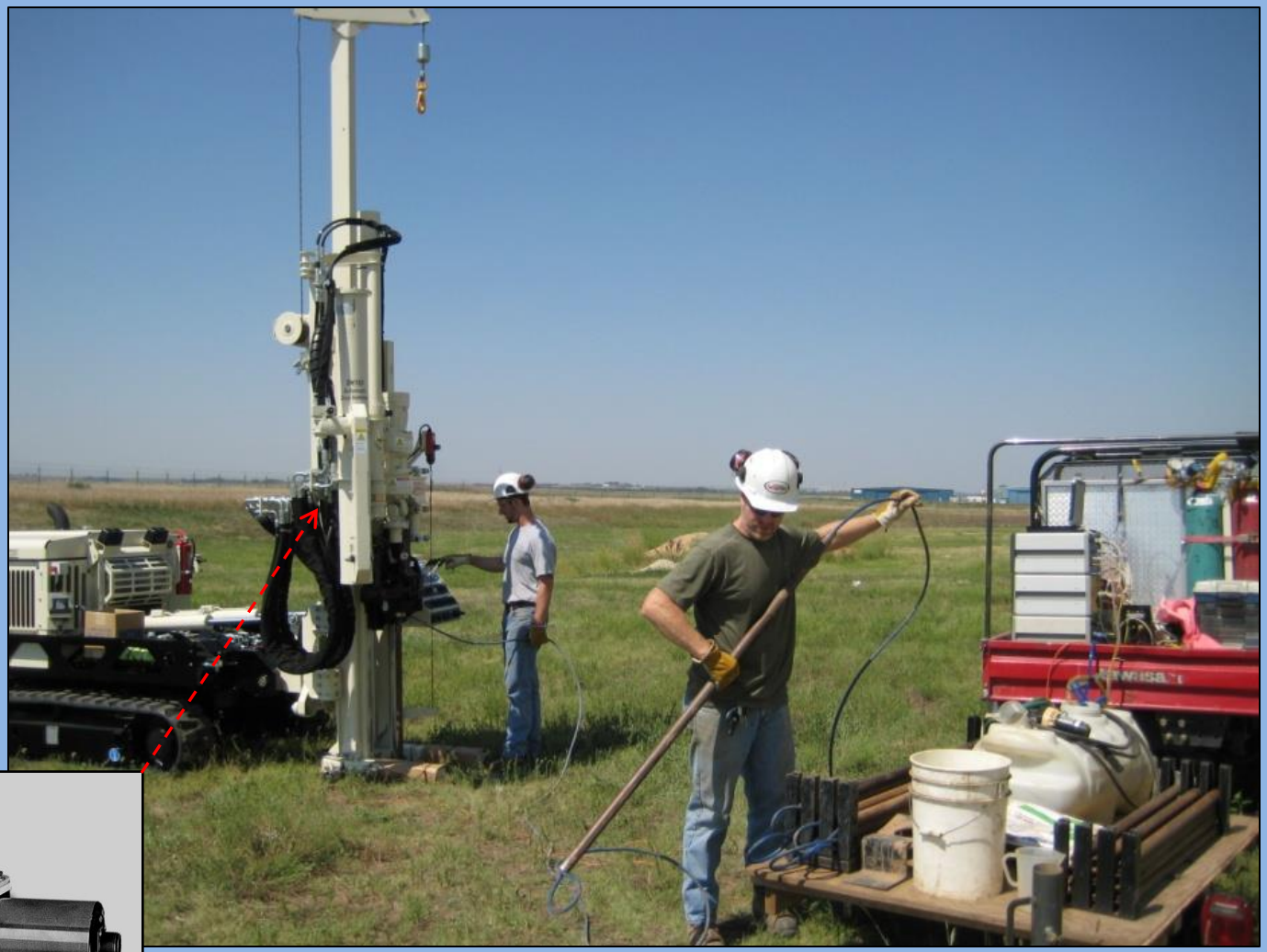
The heater block at ~100C enhances diffusion

MIP Instrumentation

- Portable Computer
- FI6000 Field Instrument
- MIP Controller
- Gas Chromatograph with three detectors:
  - PID
  - FID
  - XSD (or ECD)



Running MIP in the Field



String pot tracks depth

Advance probe incrementally

MIP QA/QC
Field VOC Response Testing

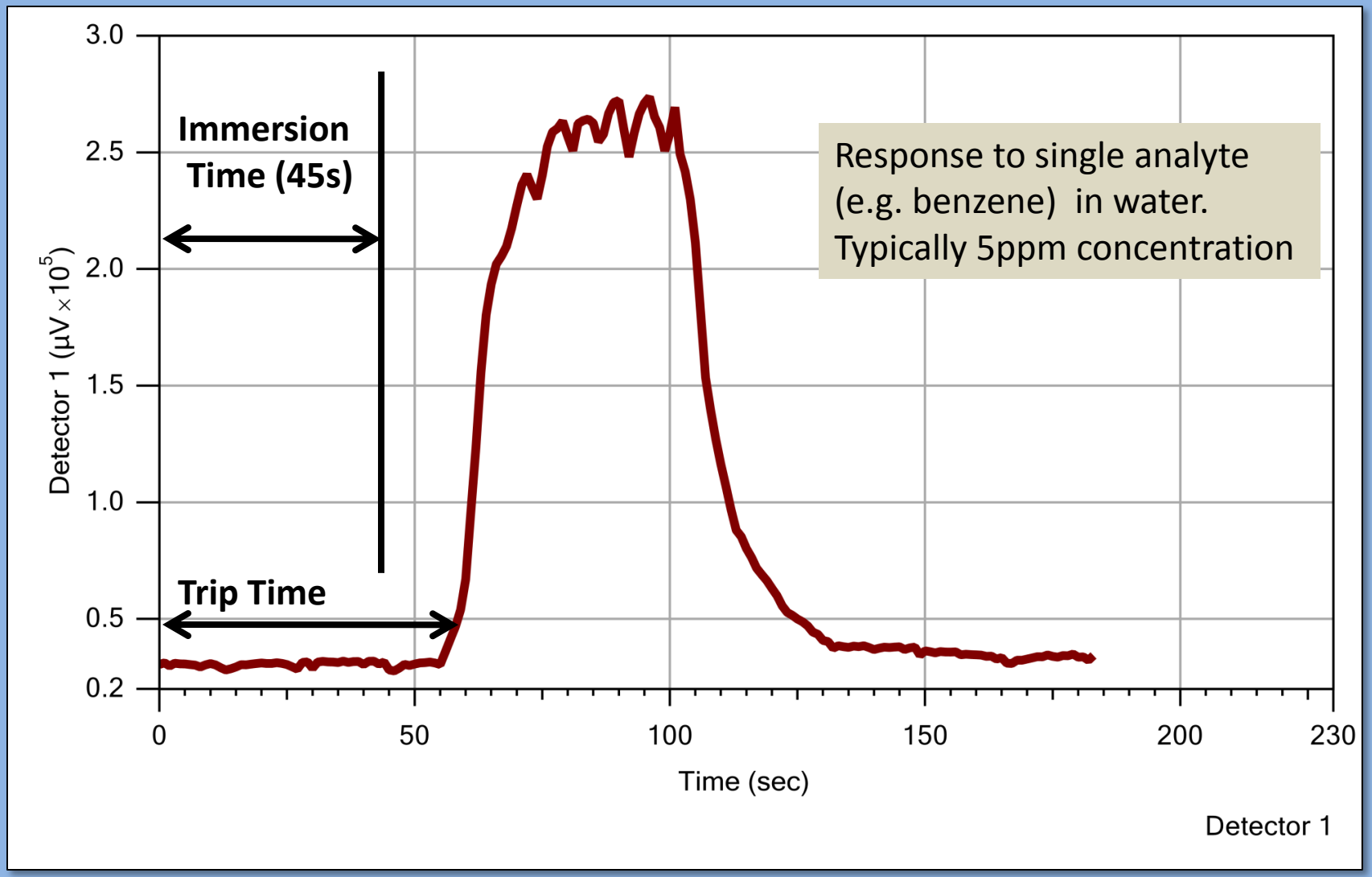
Field Standard
(e.g. Benzene,
TCE, PCE, etc.)

field standard is injected into
500ml of clean water

The heated MIP probe is
inserted into the working
standard for 45 seconds

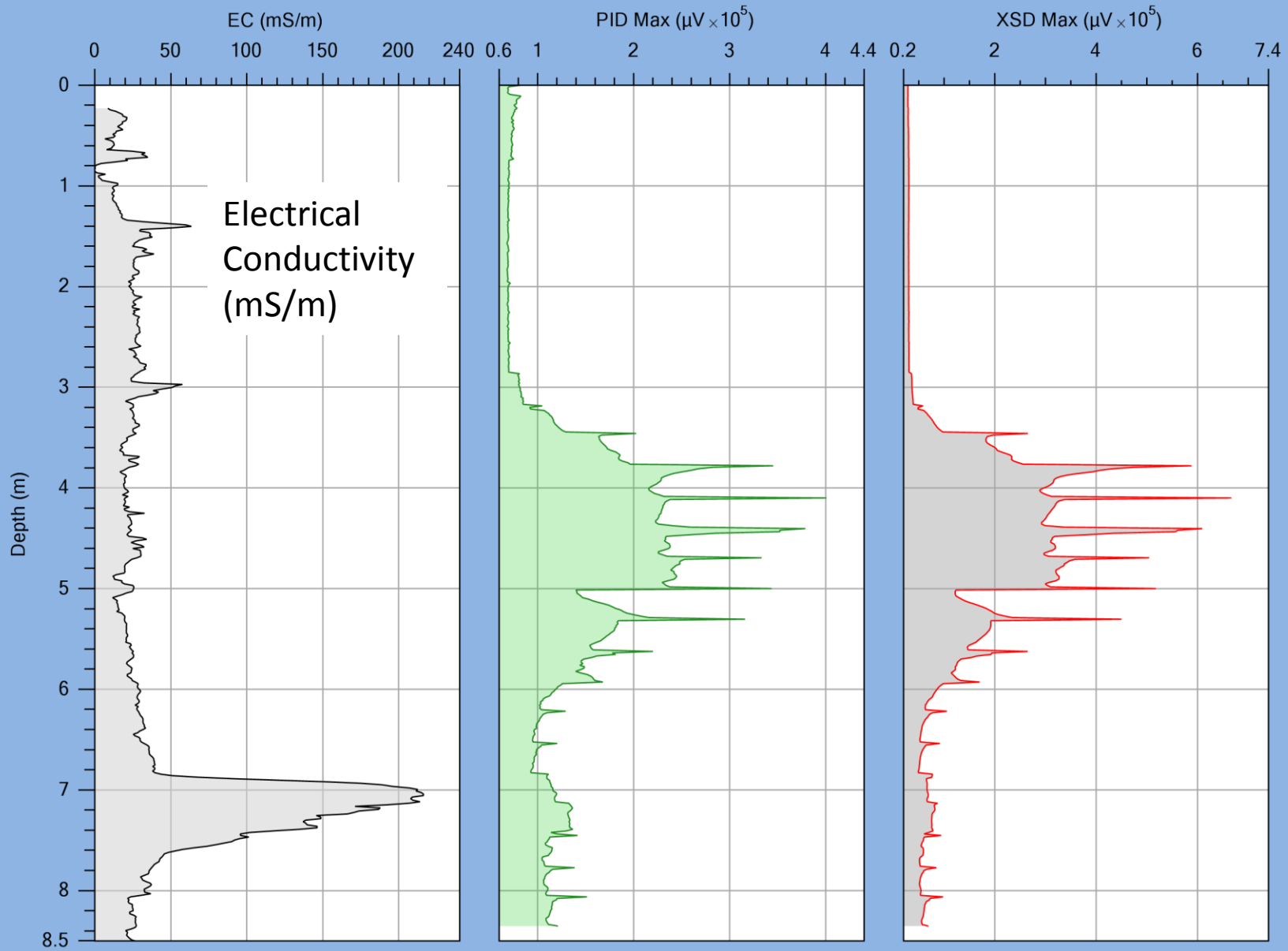
NOT A CALIBRATION

Typical Response Test

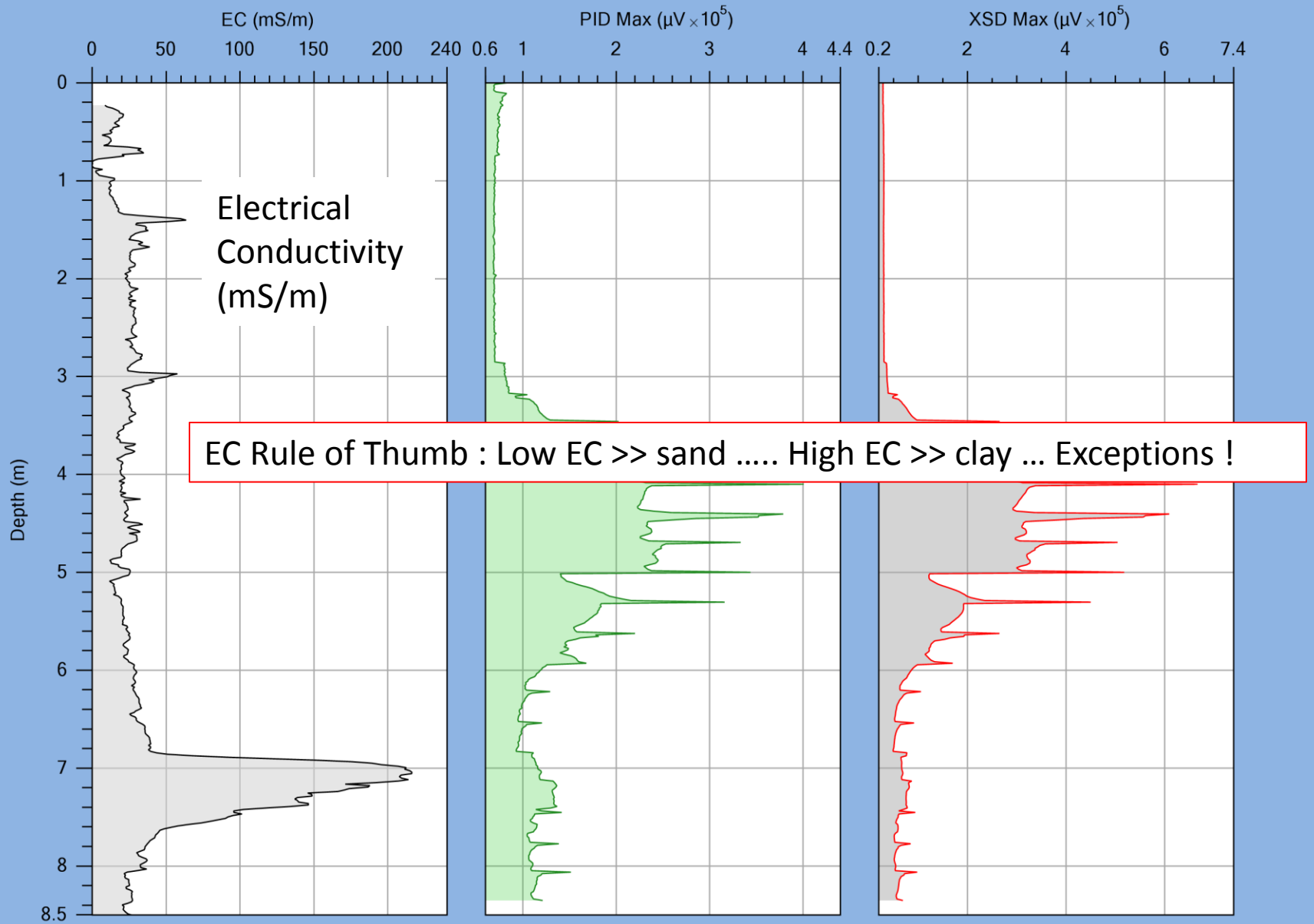


Trip time is entered into the acquisition software to correlate detector response with depth.

Example MIP Log: Skuldelev SK05



Example MIP Log



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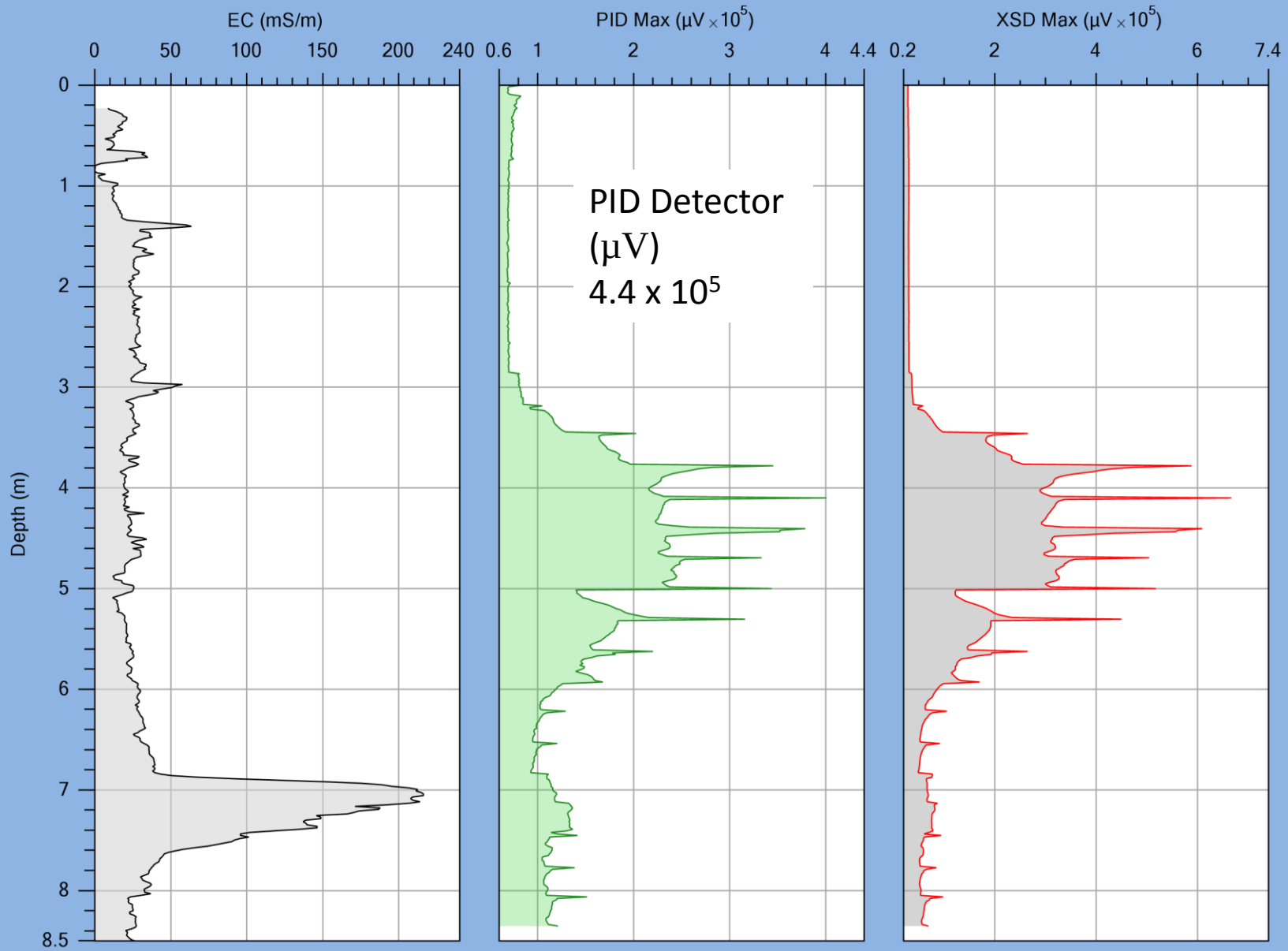
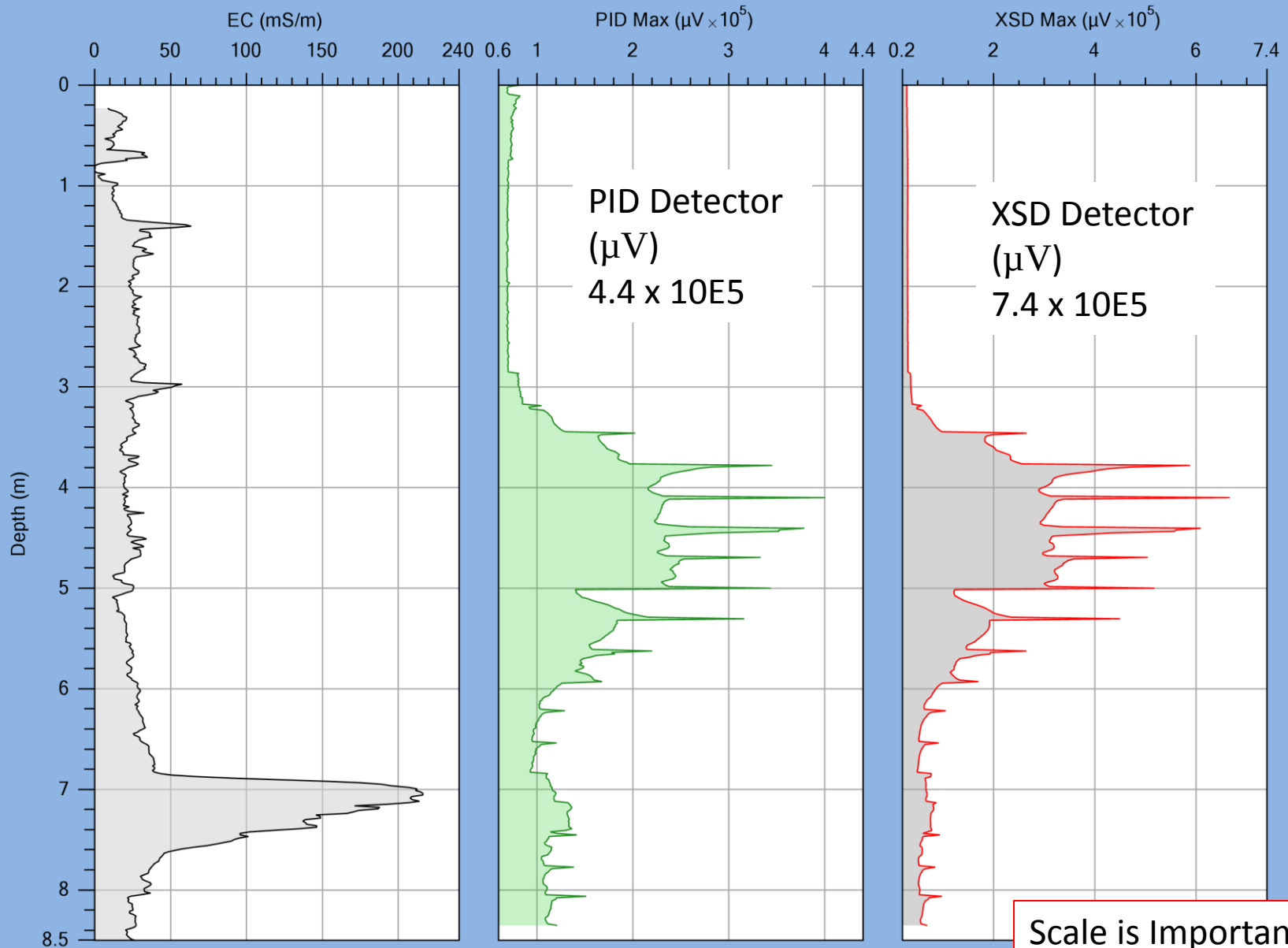
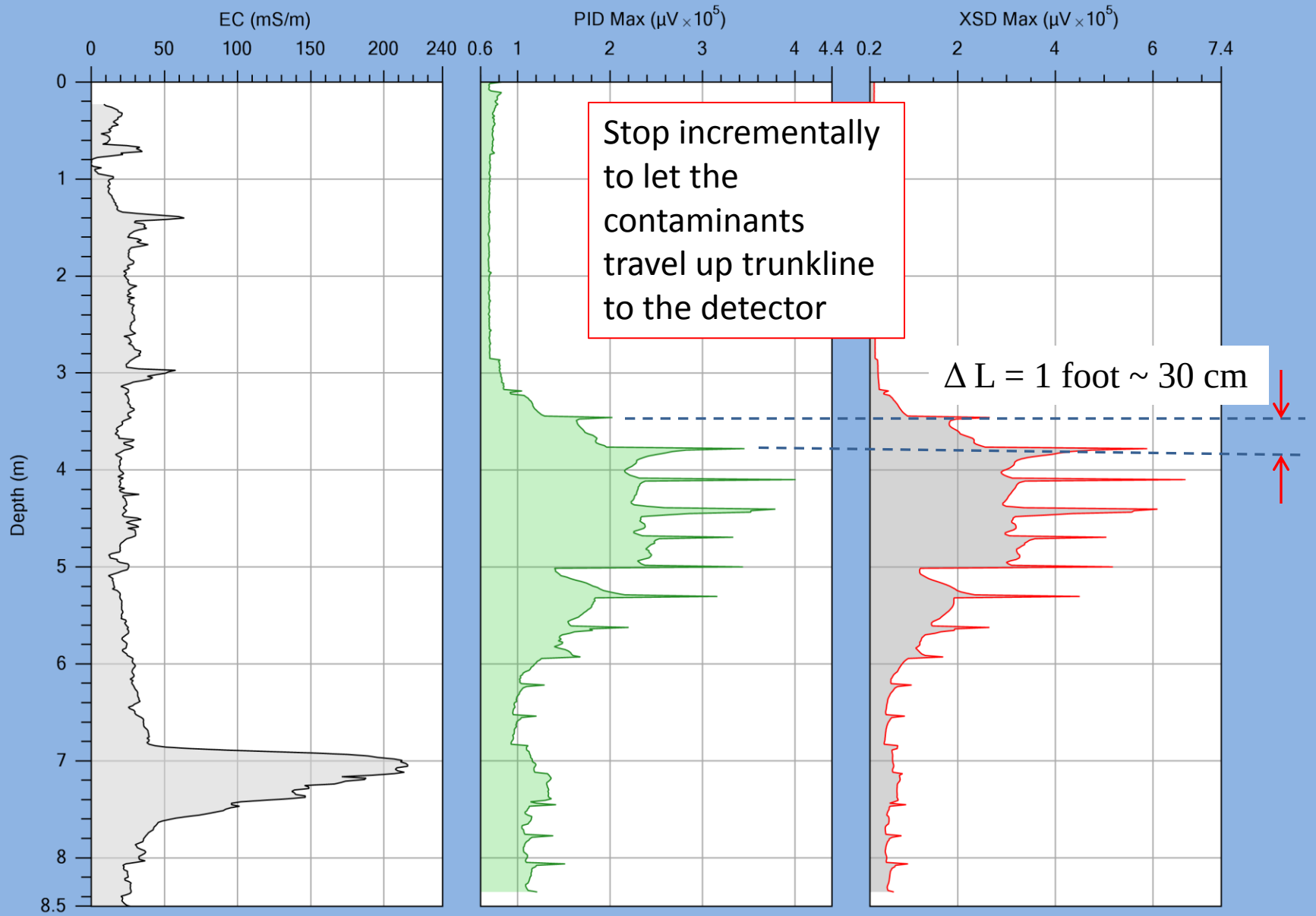


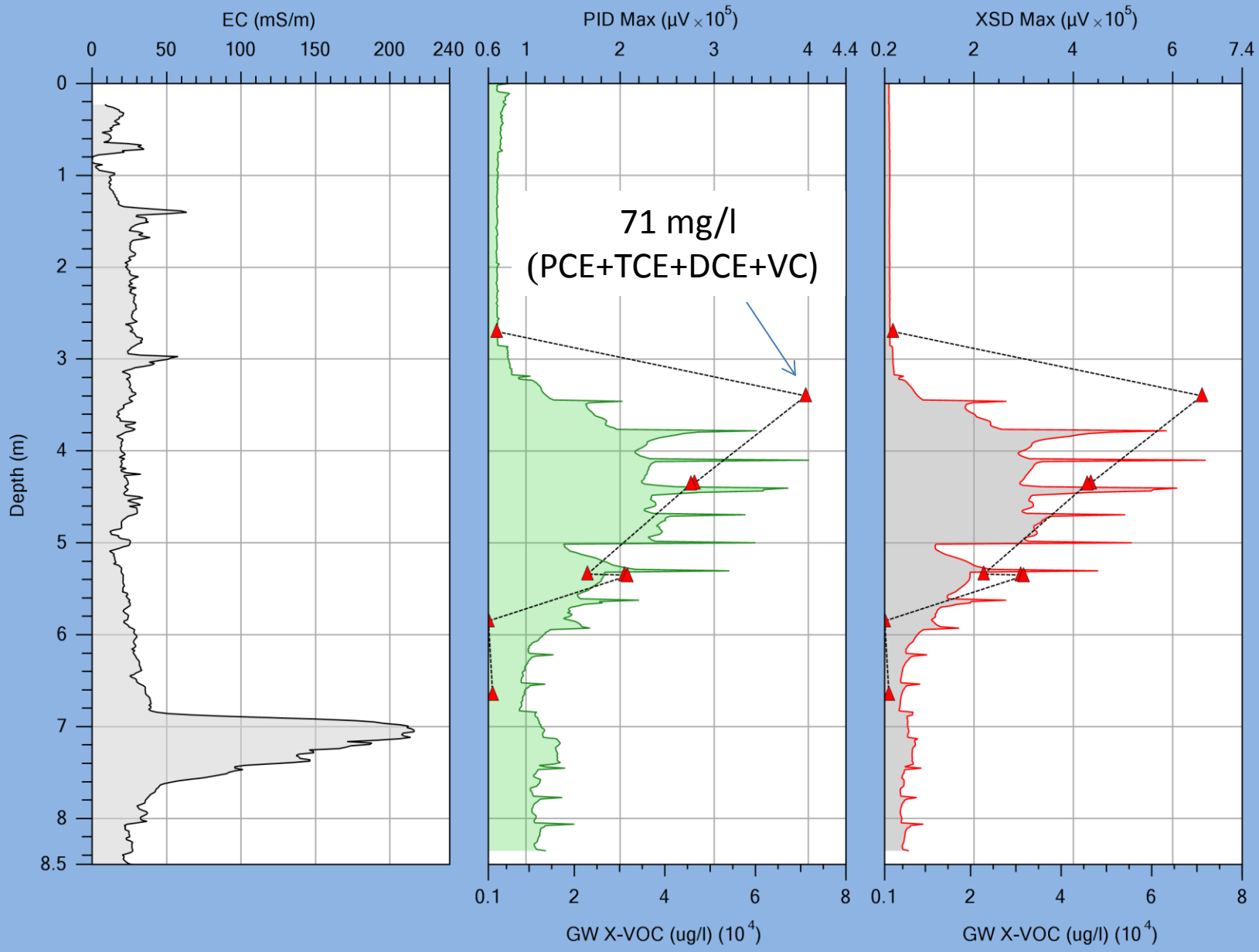
Example MIP Log



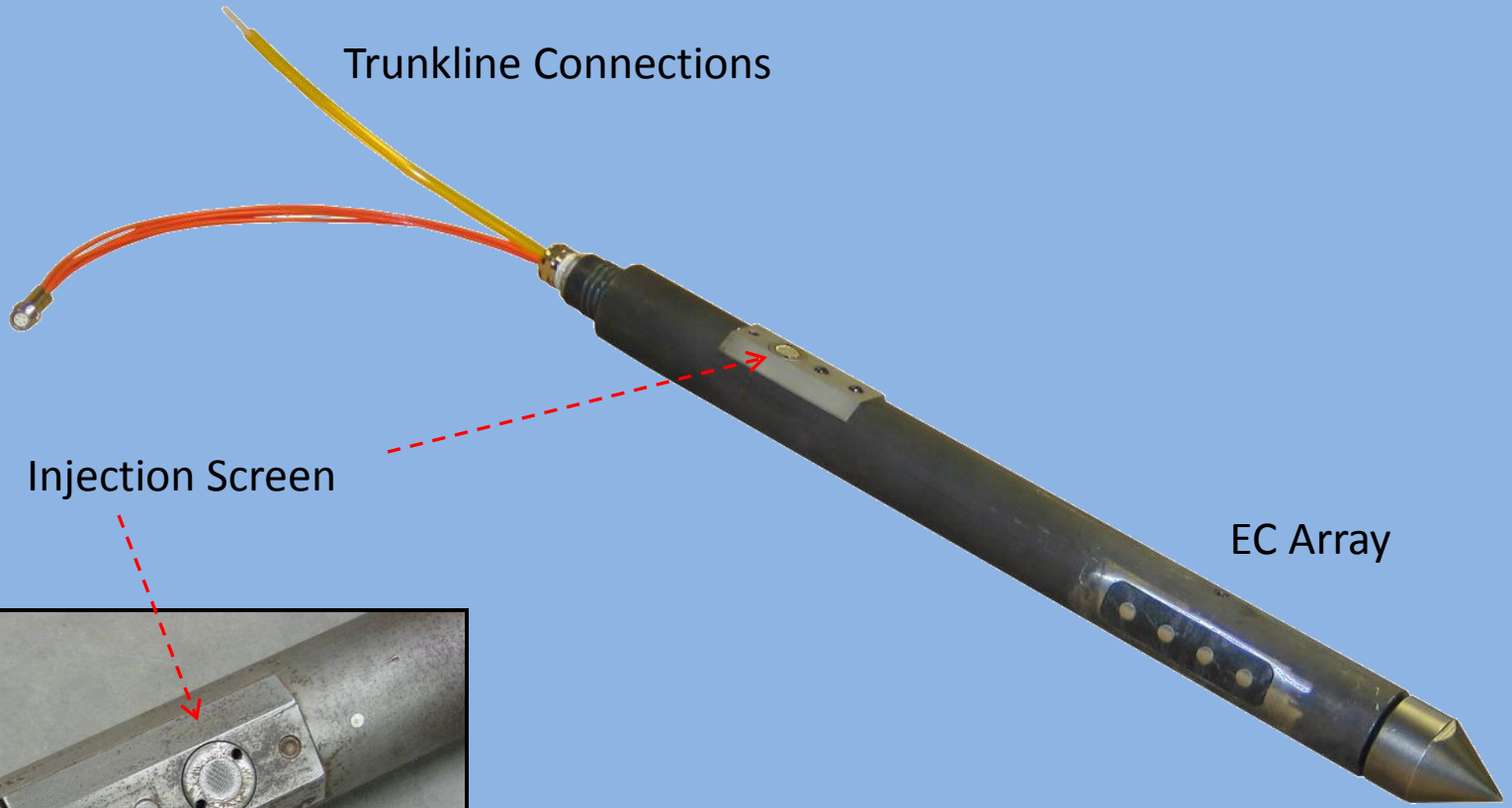
Incremental Probing & Trip Time

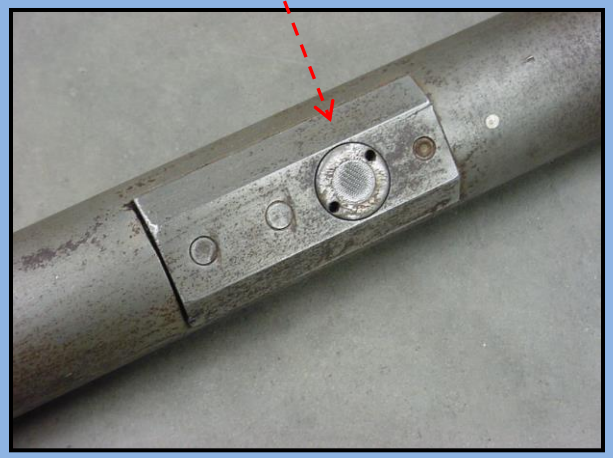


Correlating MIP Detector to Groundwater Samples



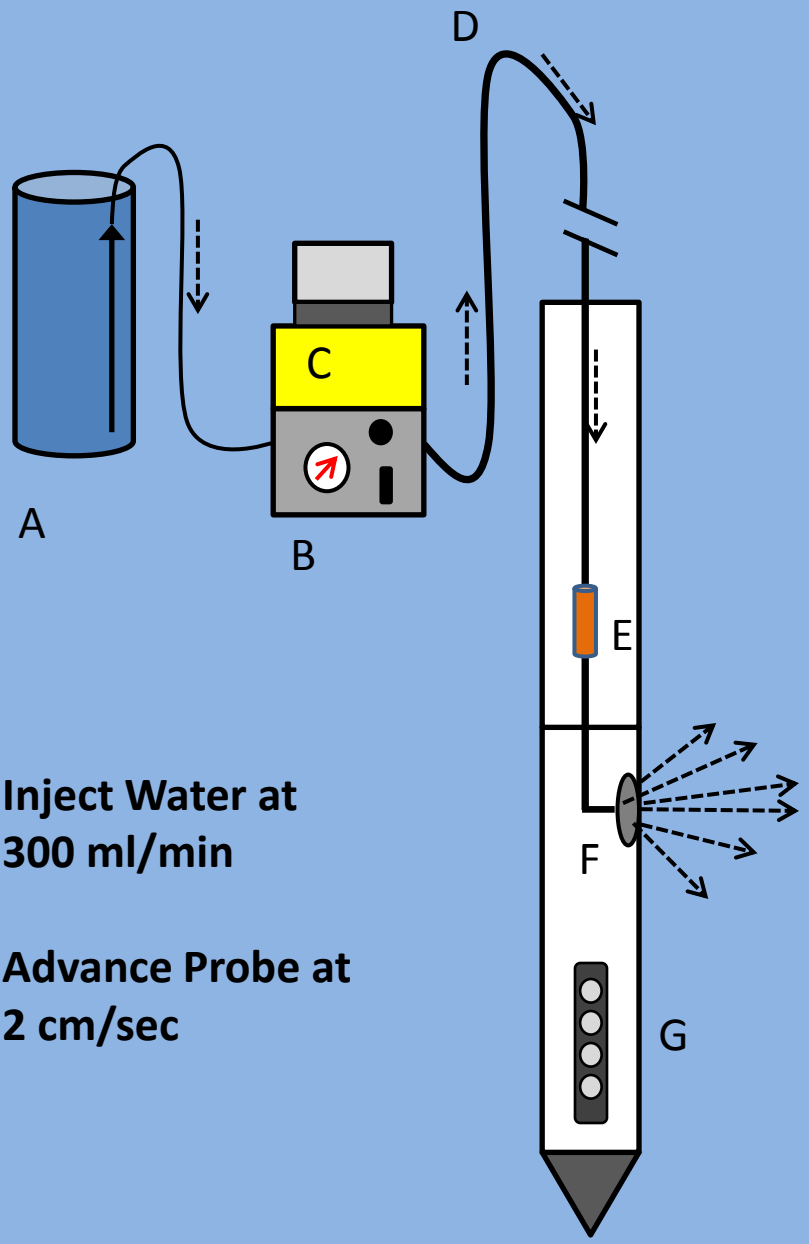
The HPT Probe & System





Replaceable
Screens

HPT Principles of Operation



Inject Water at 300 ml/min

Advance Probe at 2 cm/sec

A) Water Tank

B) Pump & Flow Meter

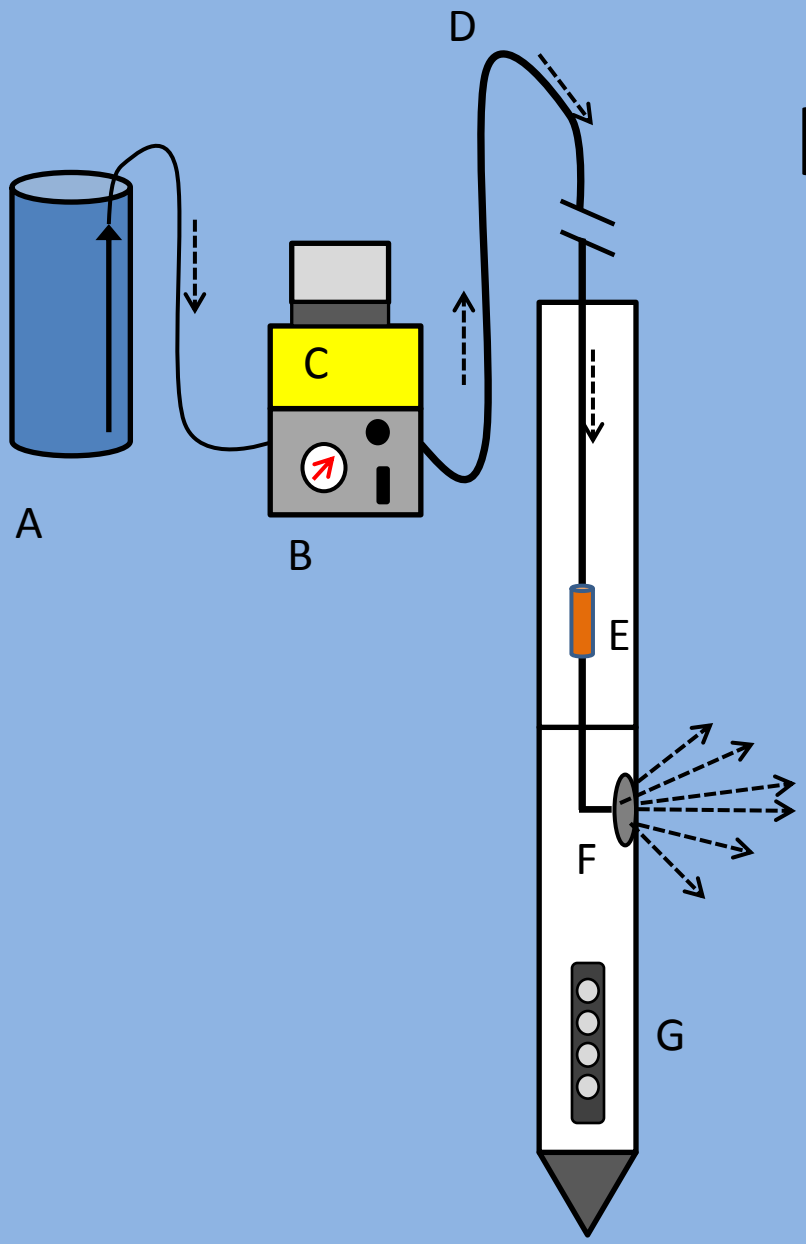
C) Electronics/computer

D) Trunkline

E) Pressure Sensor

F) Screened Injection Port

G) Elec. Conductivity Array



HPT Interpretation

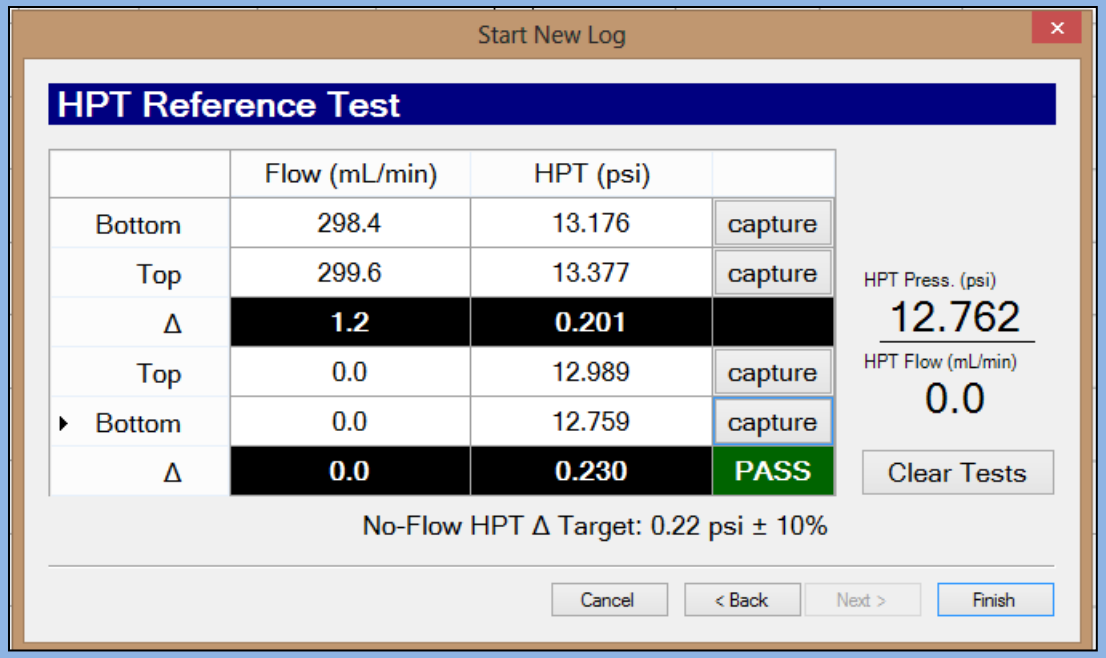
HPT Pressure Rule of Thumb:

Hi Pressure >> Lo Permeability

Low Pressure >> Hi Permeability

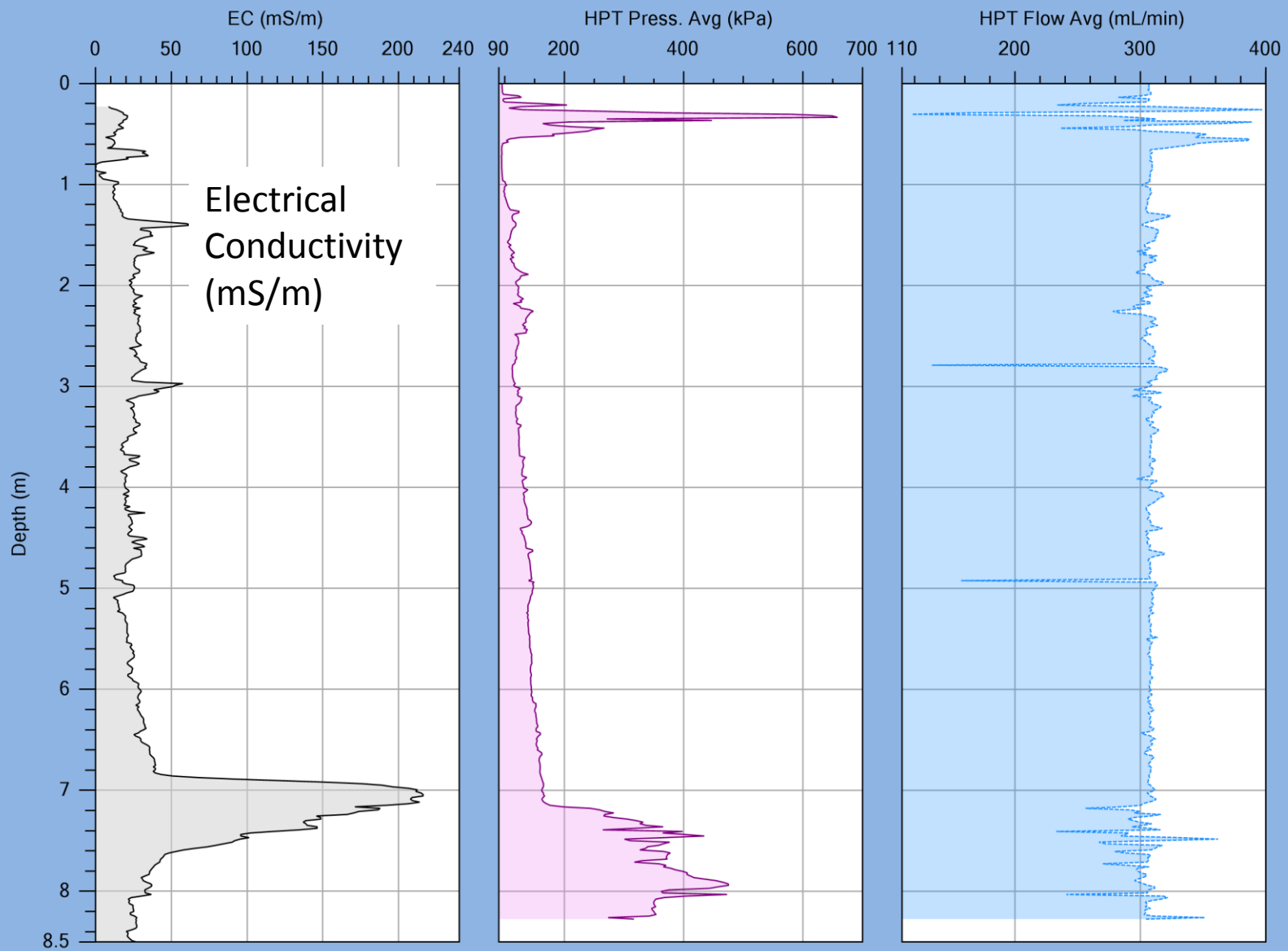
HPT QA/QC

HPT Probe in Reference Tube to Verify
Δ6” Water Pressure = 0.22 psi (1.52kPa)



HPT Pressure Transducer Onscreen QA Report
(data saved to log file)

Example HPT Log : Skuldelev SK05



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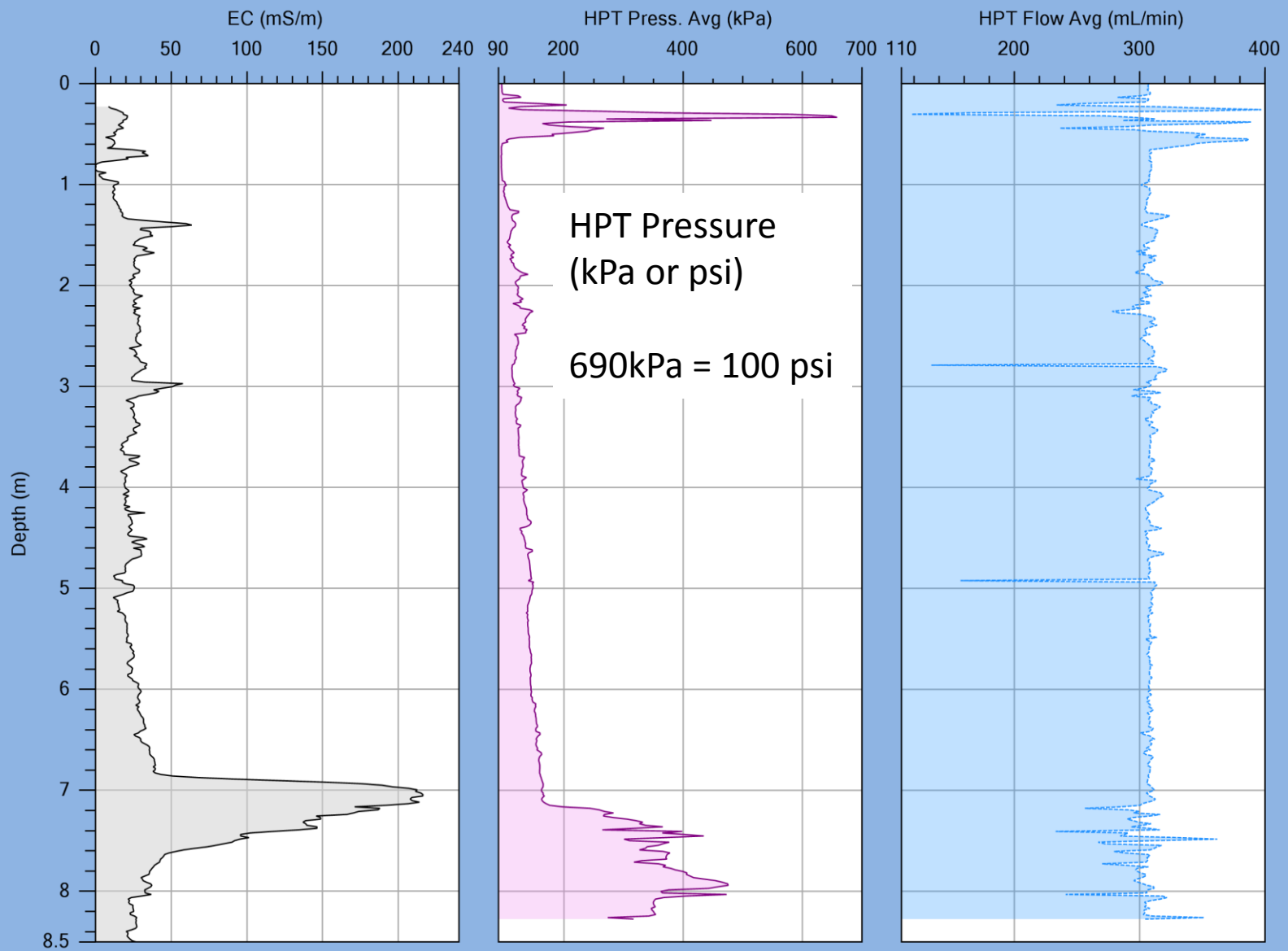

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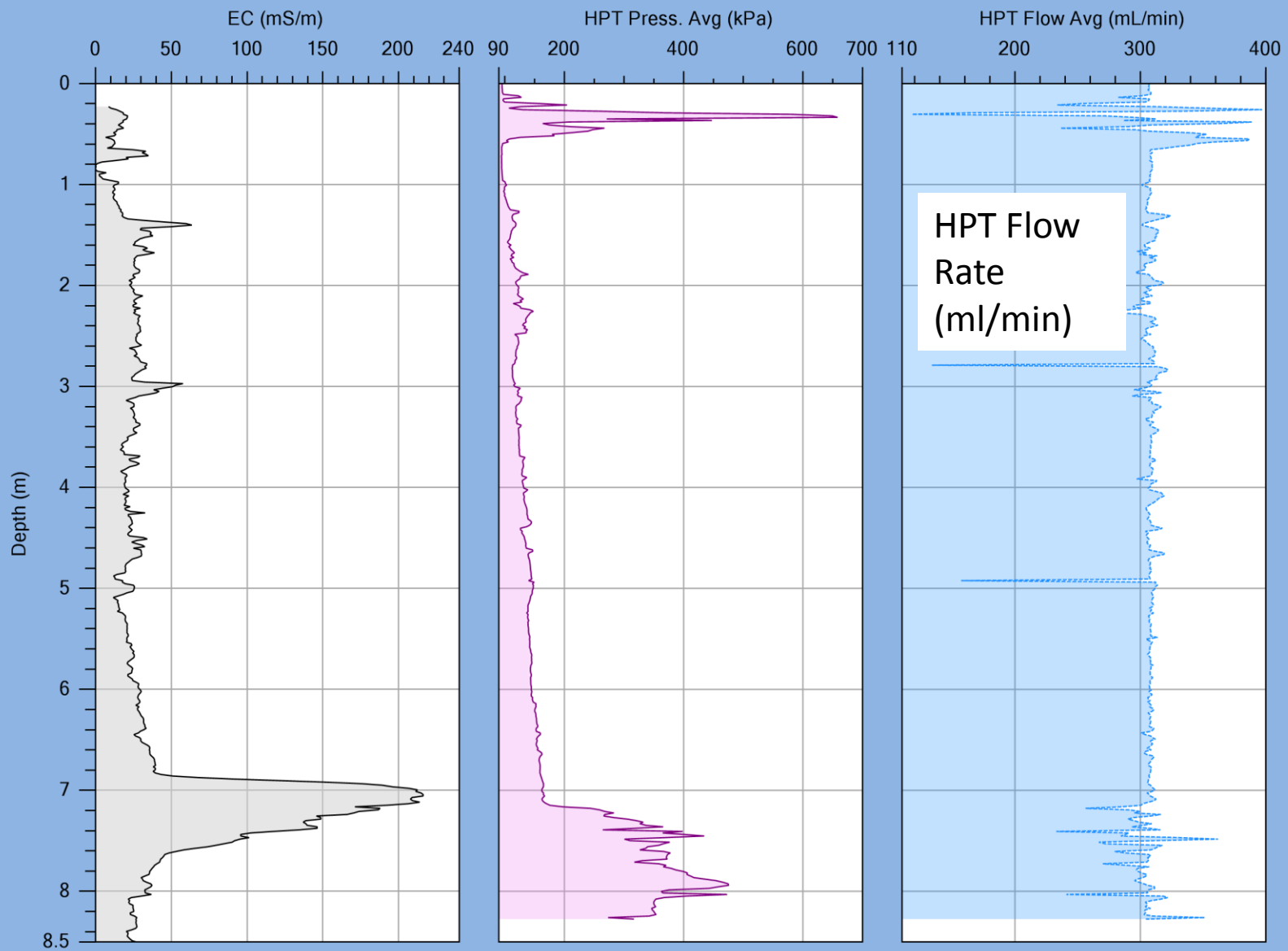

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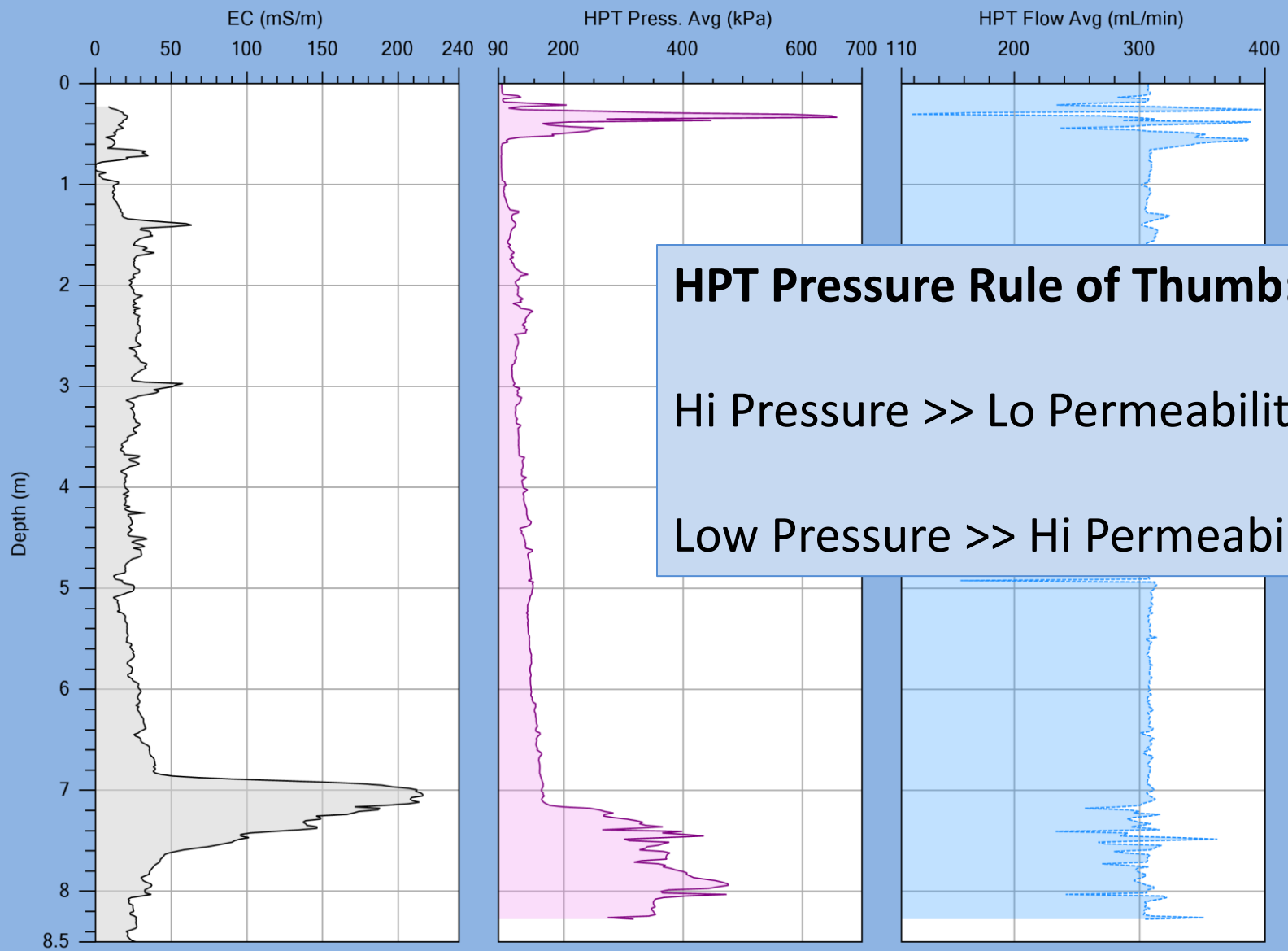

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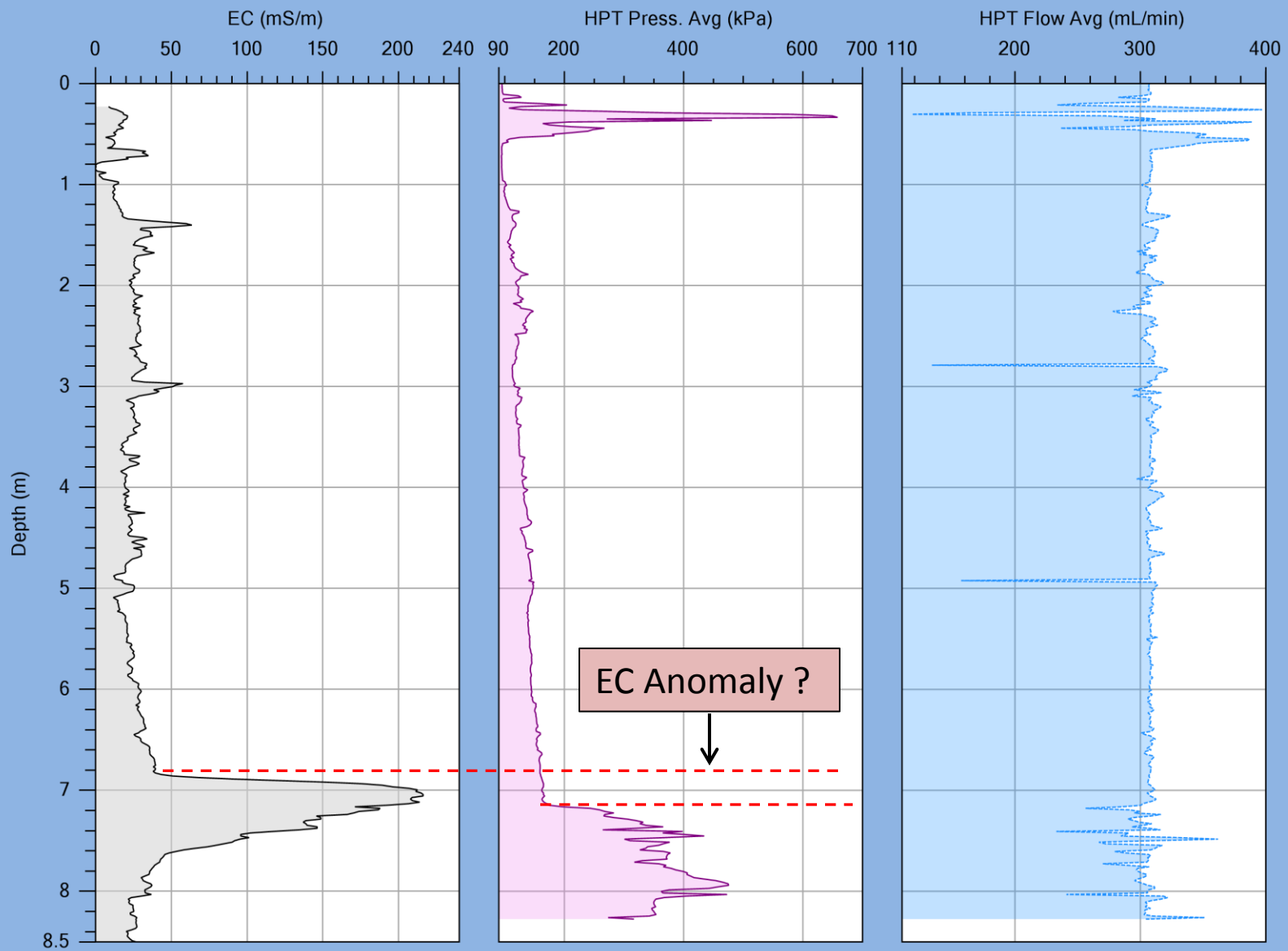
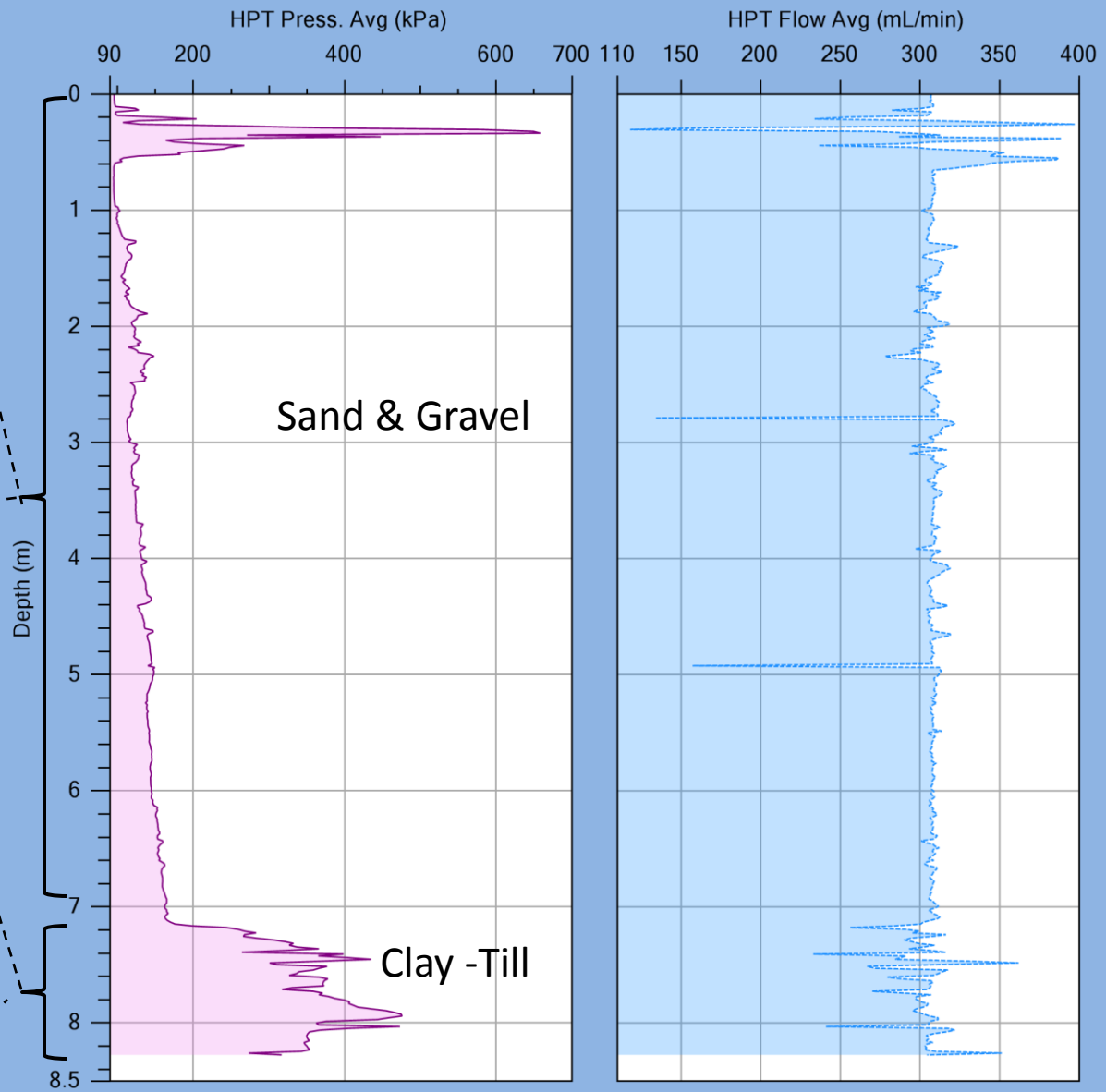
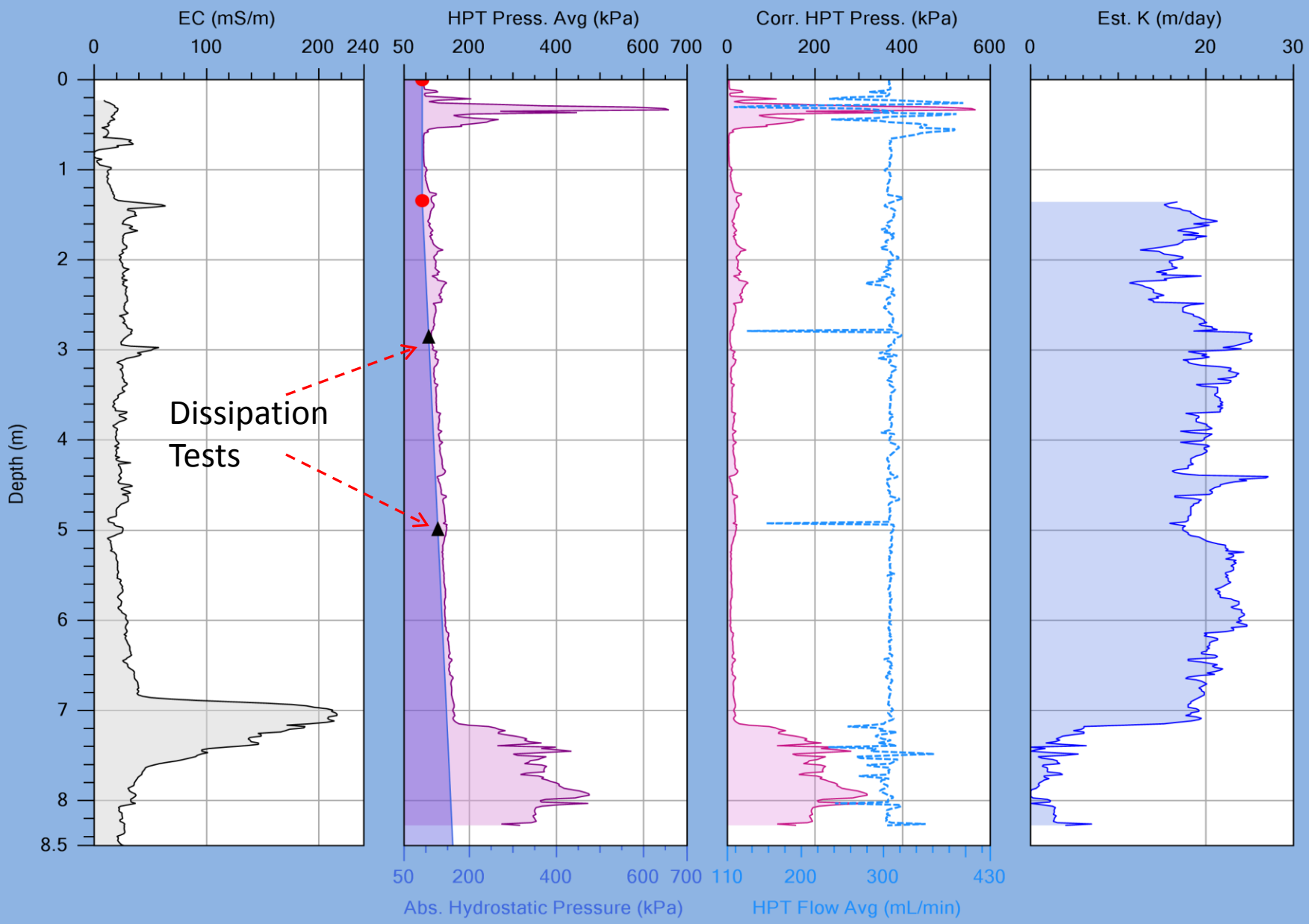
Example HPT Log : Skuldelev SK05



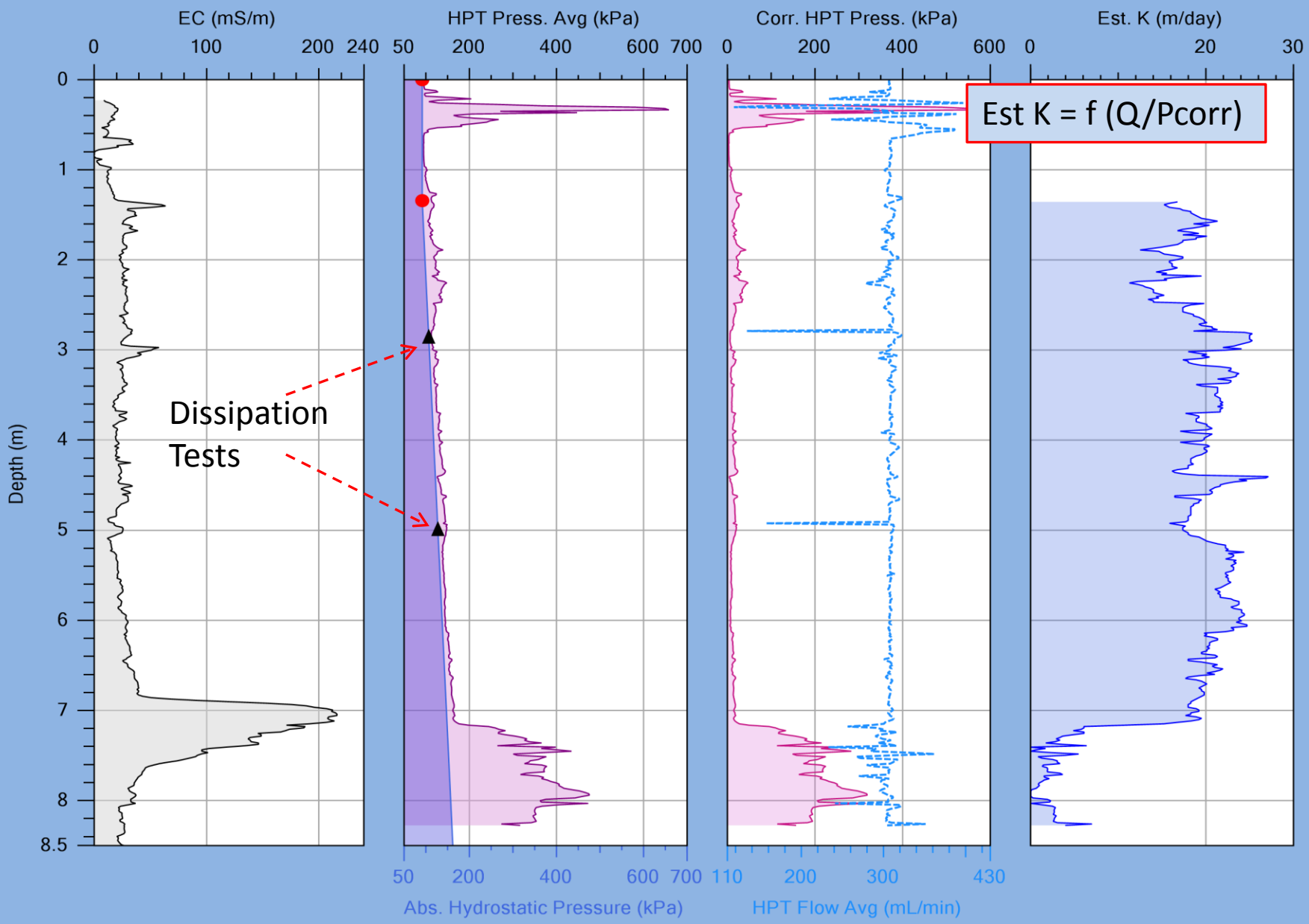
Correlating HPT Pressure to Soil Cores



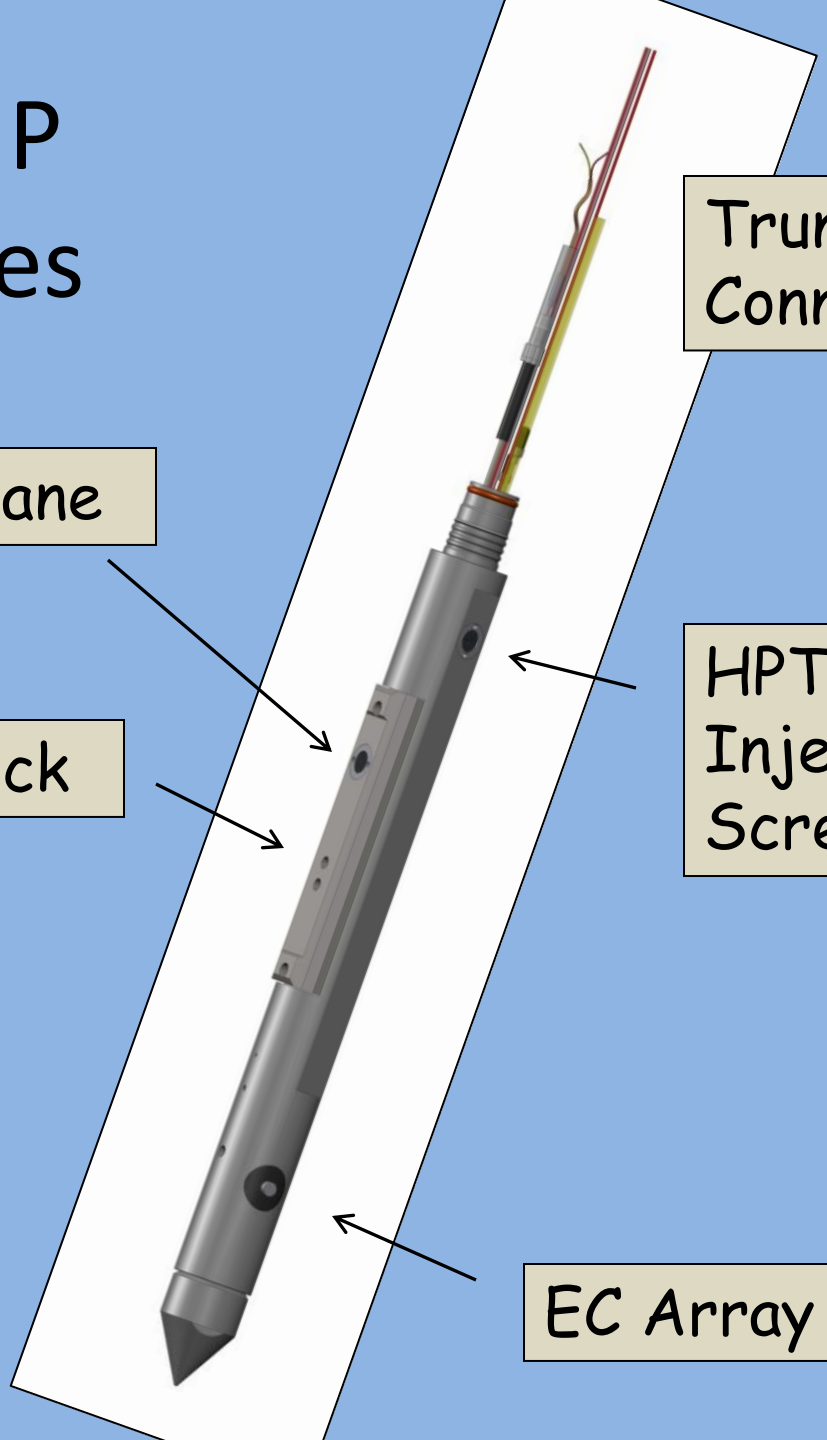
HPT and Hydrostatic > Corrected Pressure > Est K



HPT and Hydrostatic P > Corrected P > Est K

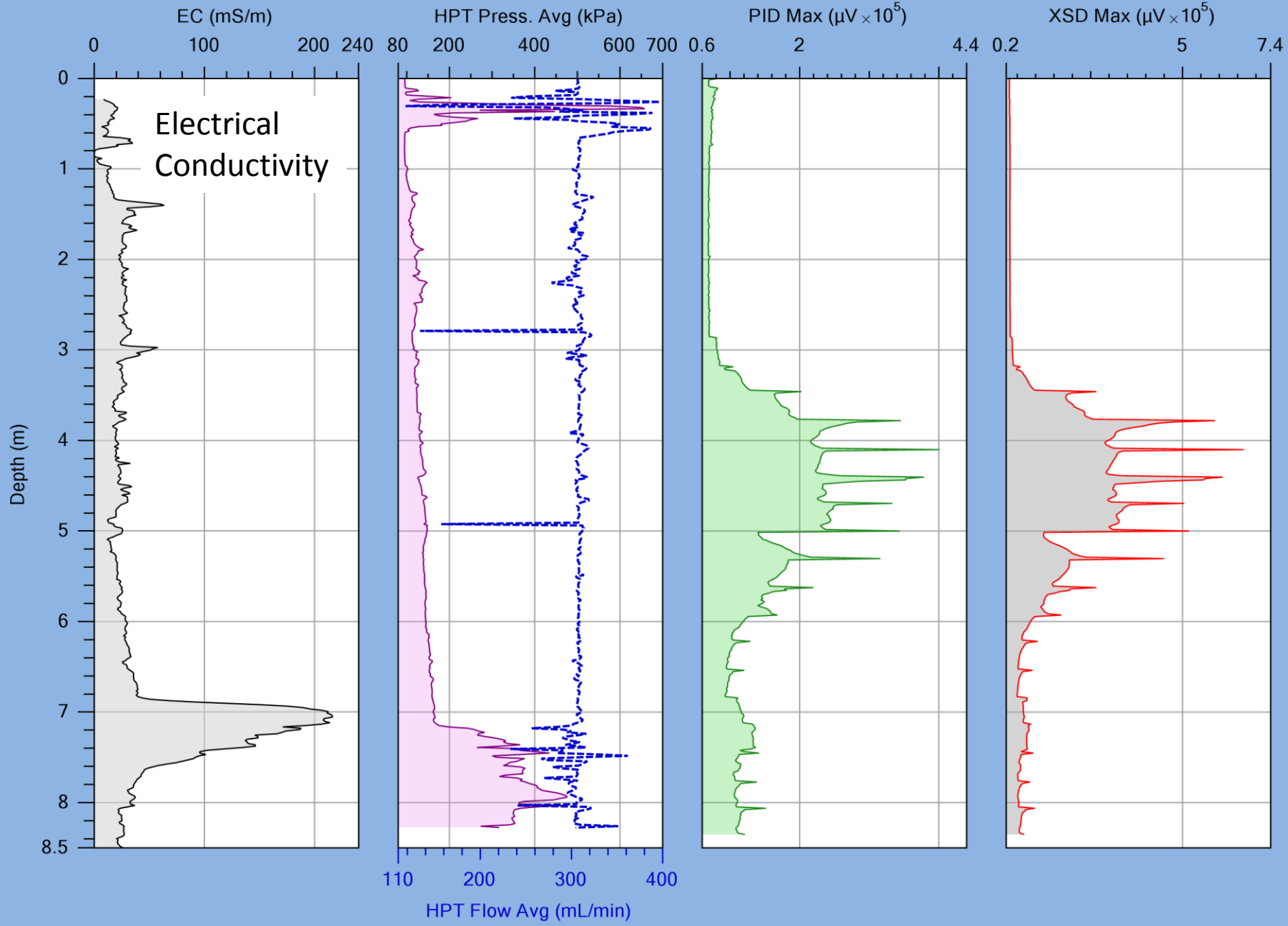


Combining MIP and HPT Probes



MiHpt

The MiHpt Log : SK05 at Skuldelev



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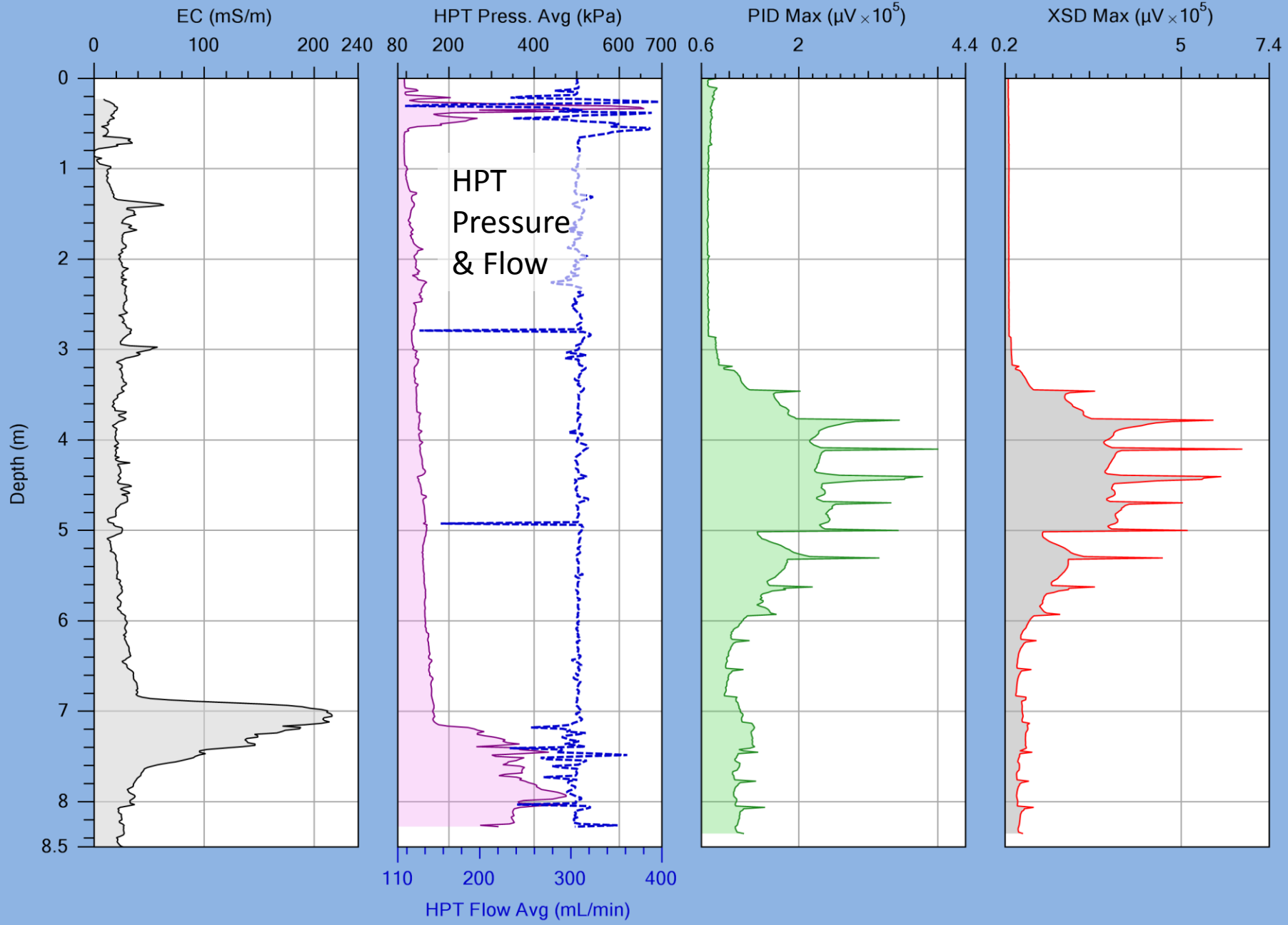

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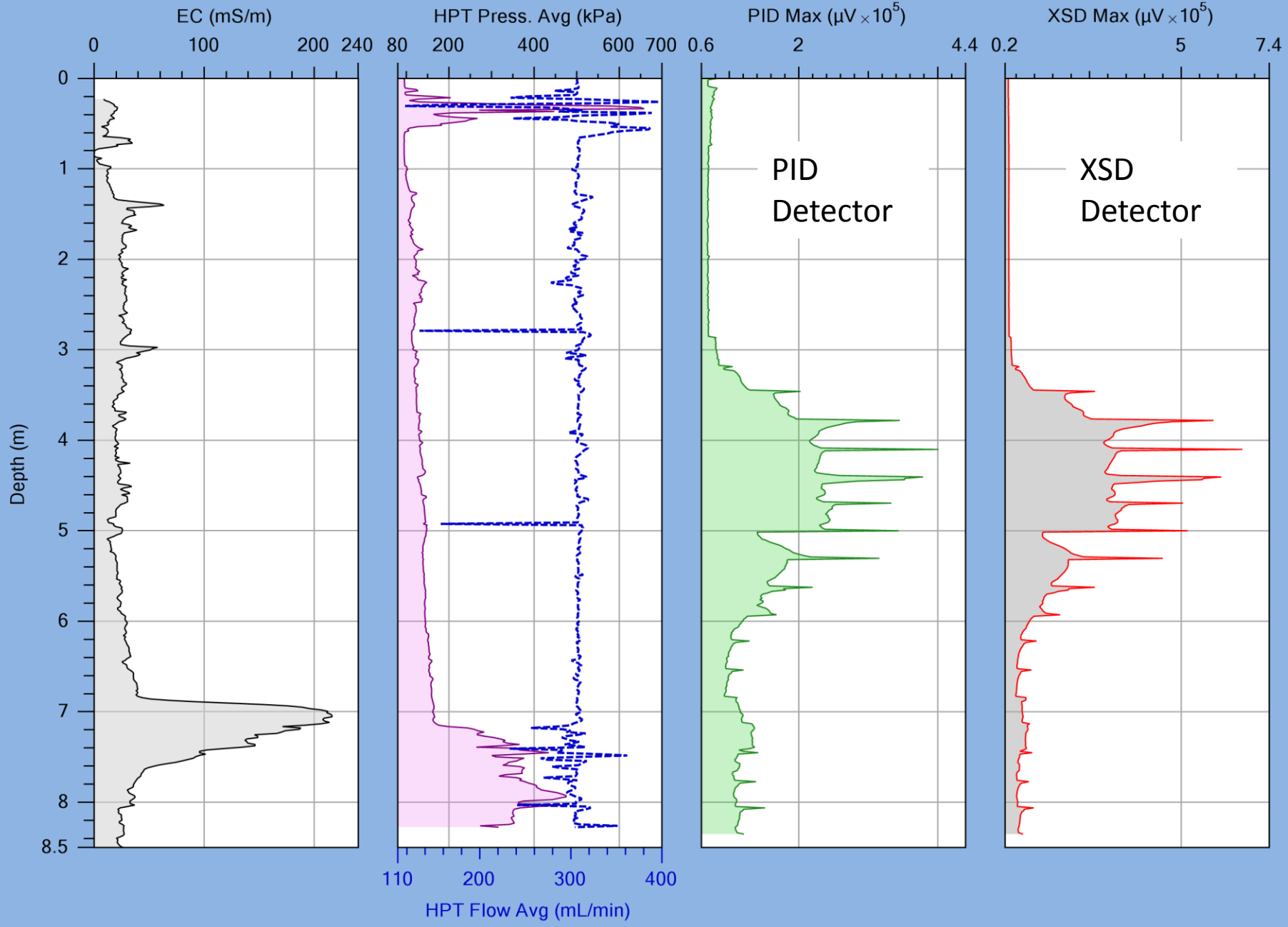


Location of Skuldelev, Denmark

Skuldelev Geology

Glaciated Region

Site underlain by glacial till and related unconsolidated deposits

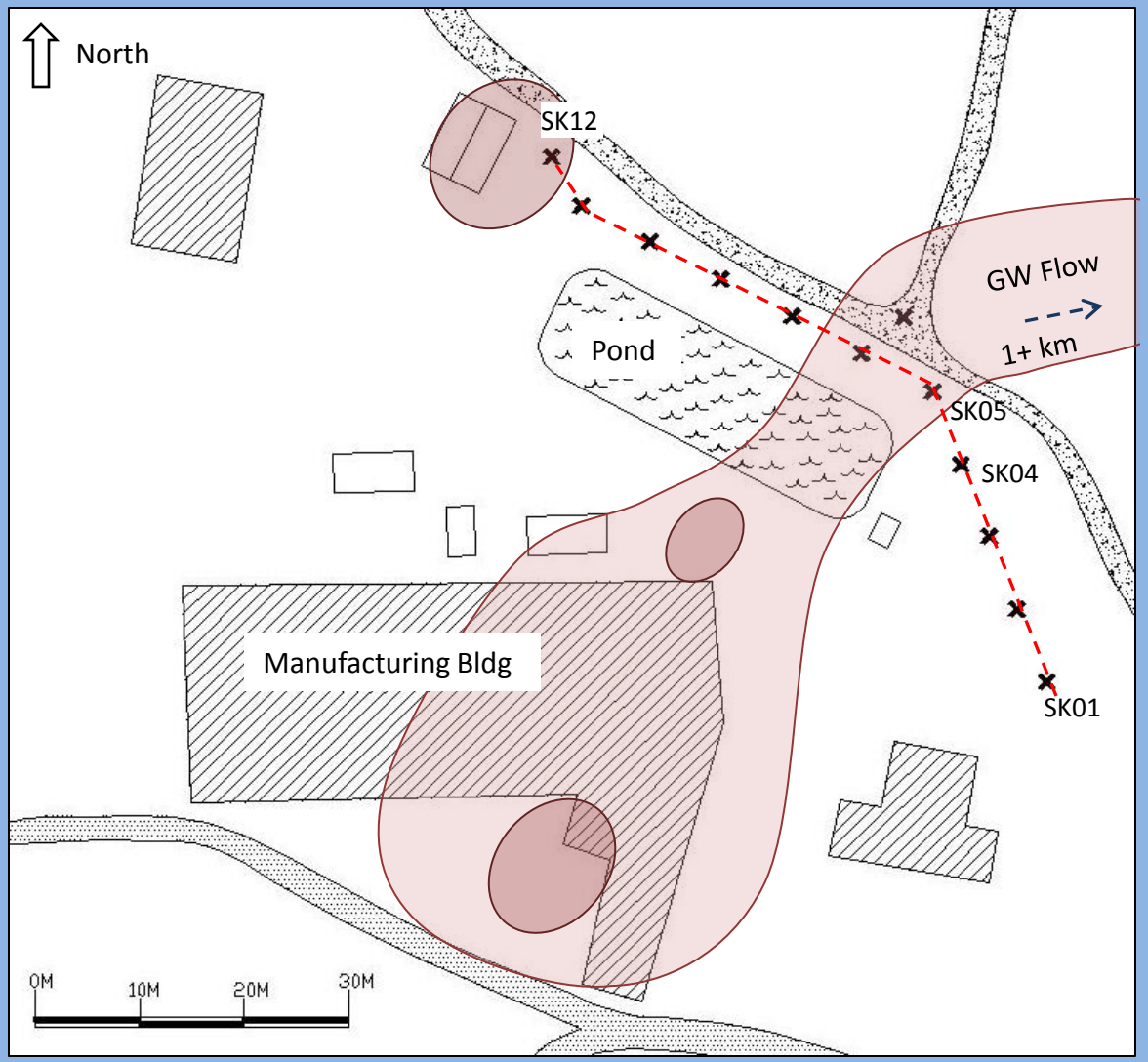
Skuldelev Site Map

MiHpt Log **X**

Cross section Line - - - - -

GW Plume & Hot Spot

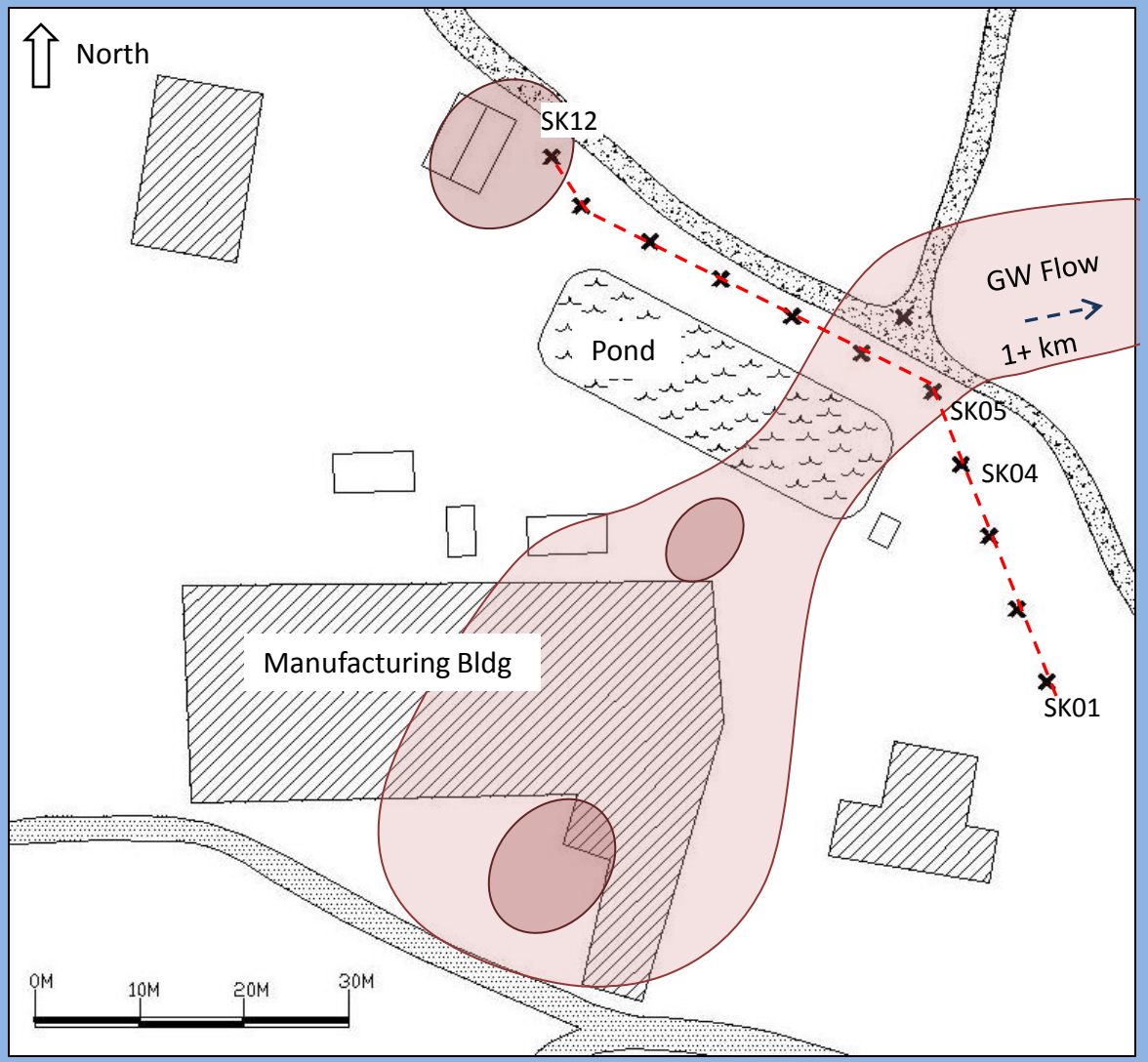
PCE, TCE, DCE & VC



Logs are spaced 8 m (~25ft) apart.

Skuldelev Site Map

EC at this site did not differentiate between the clay-till and the sand & gravel



MiHpt Log **X**

Cross section Line - - - - -

GW Plume & Hot Spot

PCE, TCE, DCE & VC

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Skuldelev Denmark & Site Map

MiHpt Log **X**

Cross section Line - - - - -

GW Plume & Hot Spot

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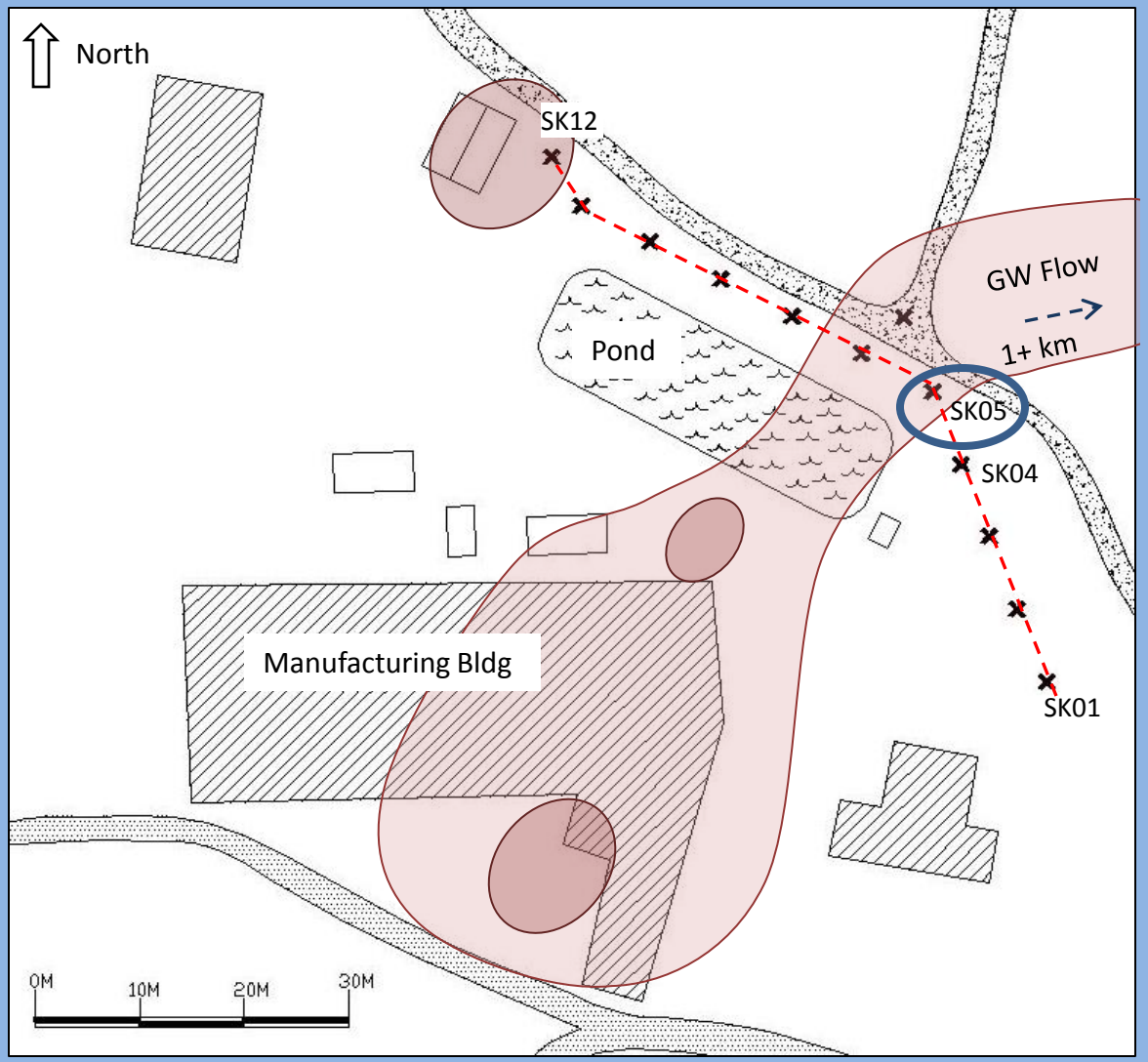

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Skuldelev Location & Site Map

MiHpt Log **X**

Cross section Line - - - - -

GW Plume & Hot Spot

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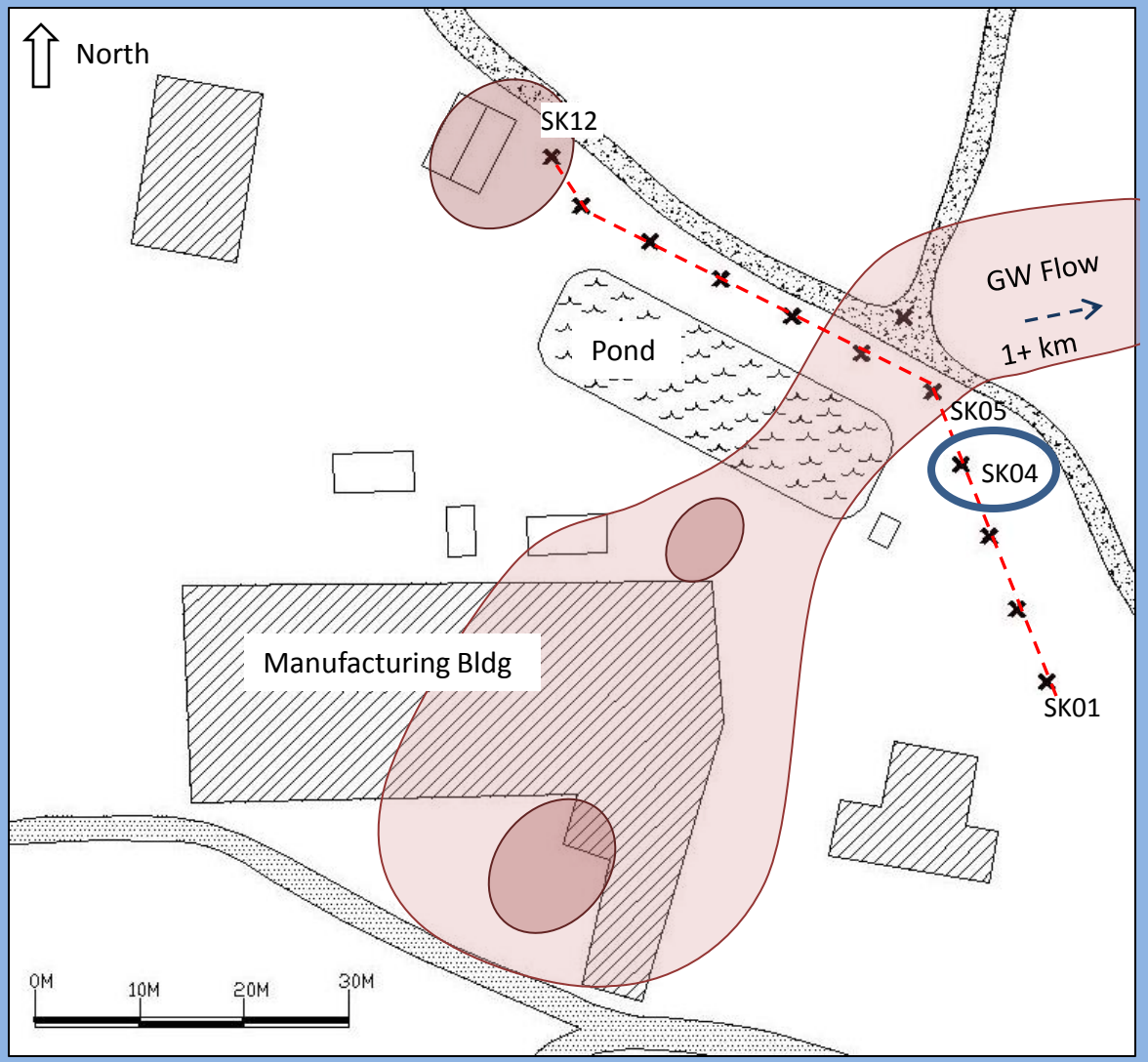

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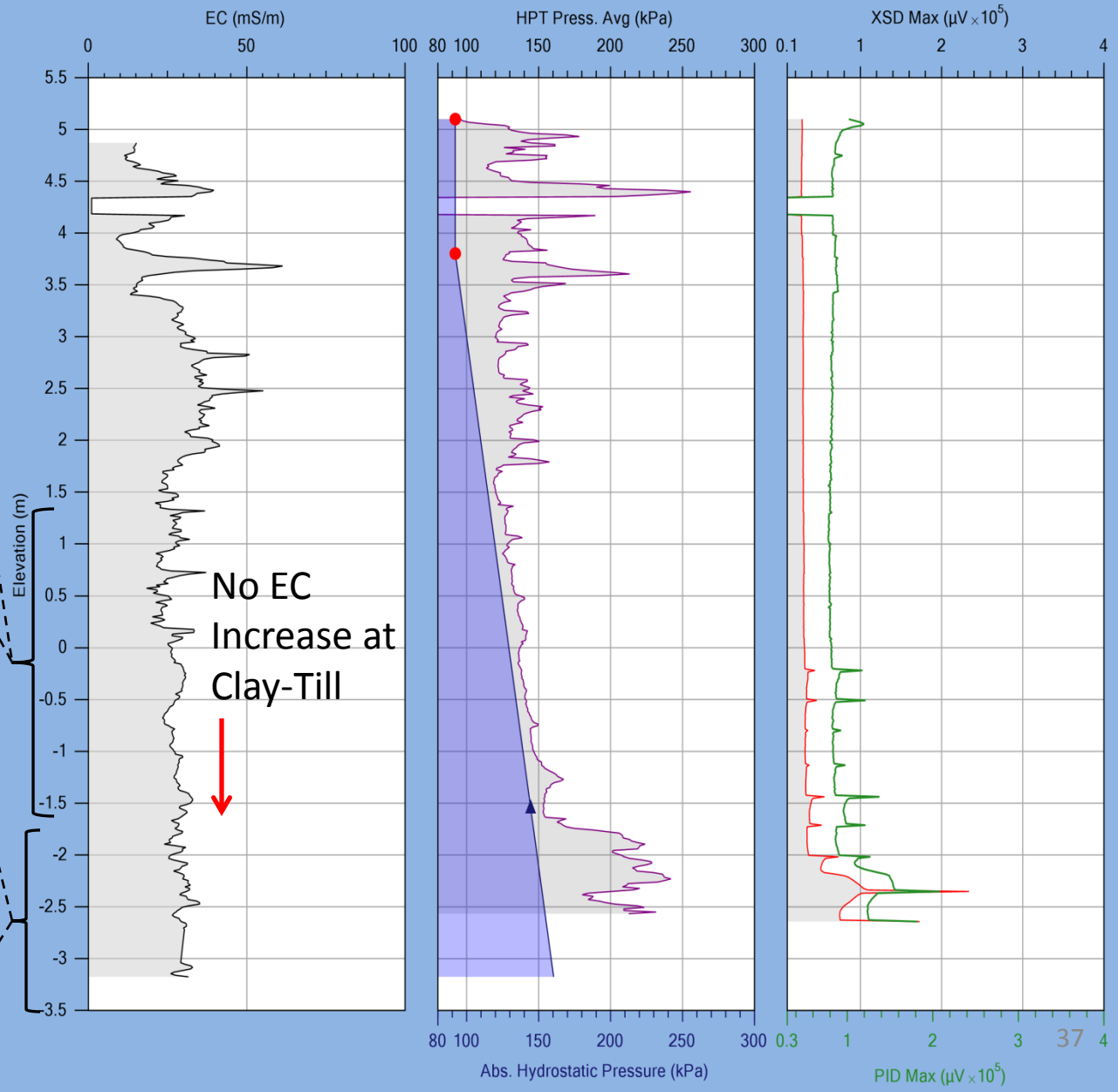
Skuldelev SK04 Location Log

Sand & Gravel

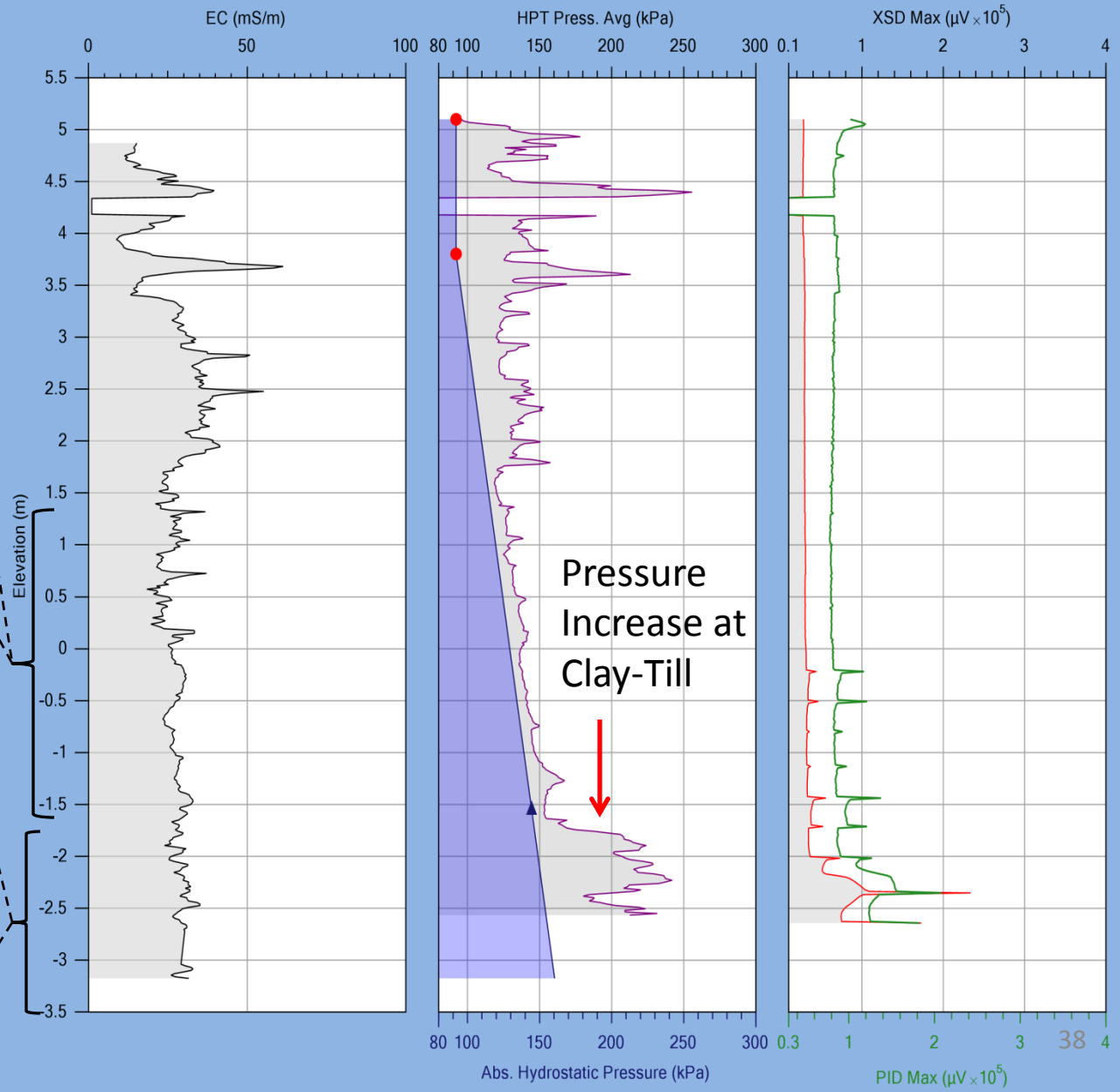
Clay-Till



Skuldelev SK04 Location Log

Sand & Gravel

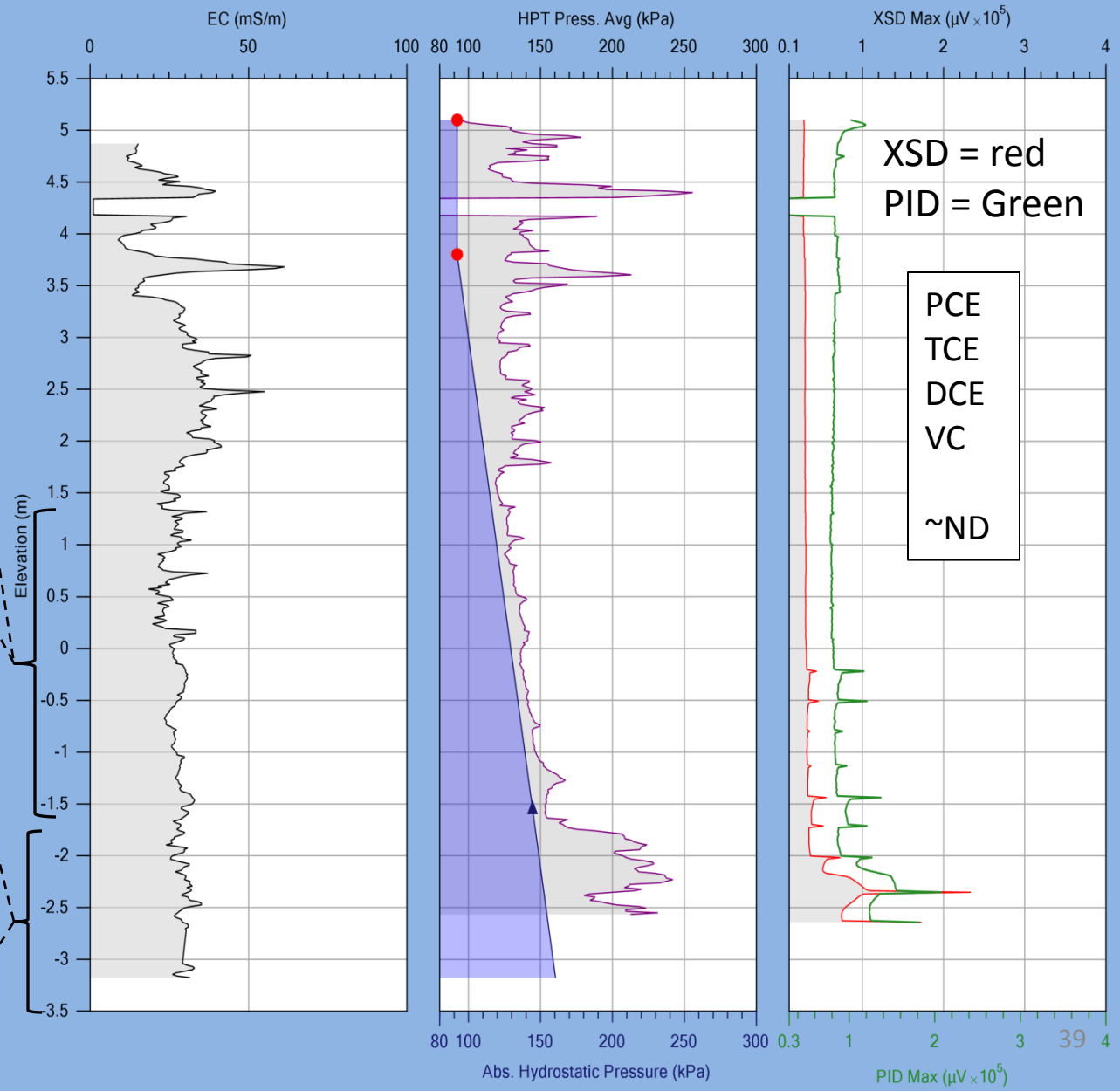
Clay-Till



Skuldelev SK04 Location Log

Sand & Gravel

Clay-Till



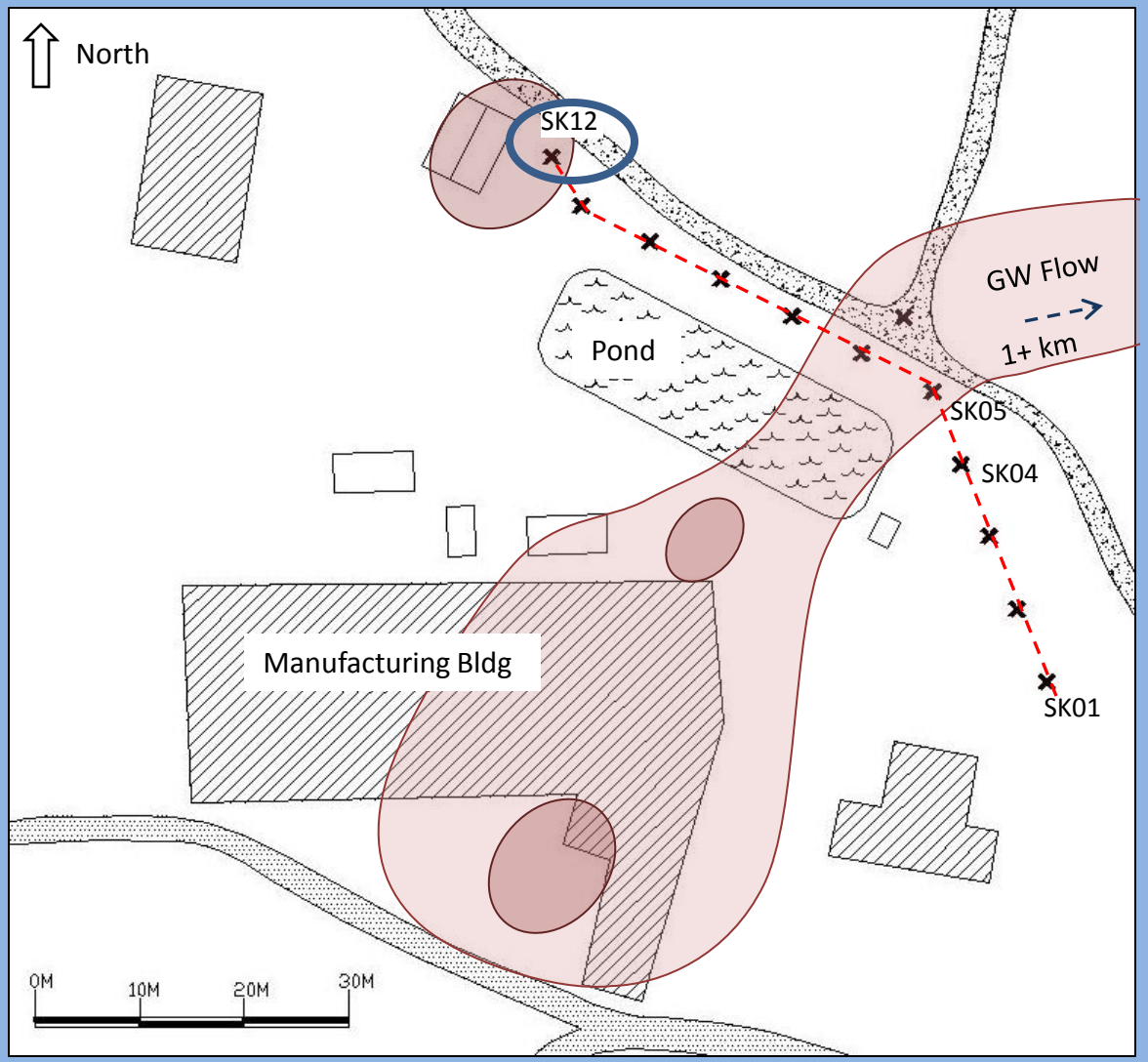
Skuldelev : SK12 Location

MiHpt Log **X**

Cross section Line - - - - -

GW Plume & Hot Spot

PCE, TCE, DCE & VC



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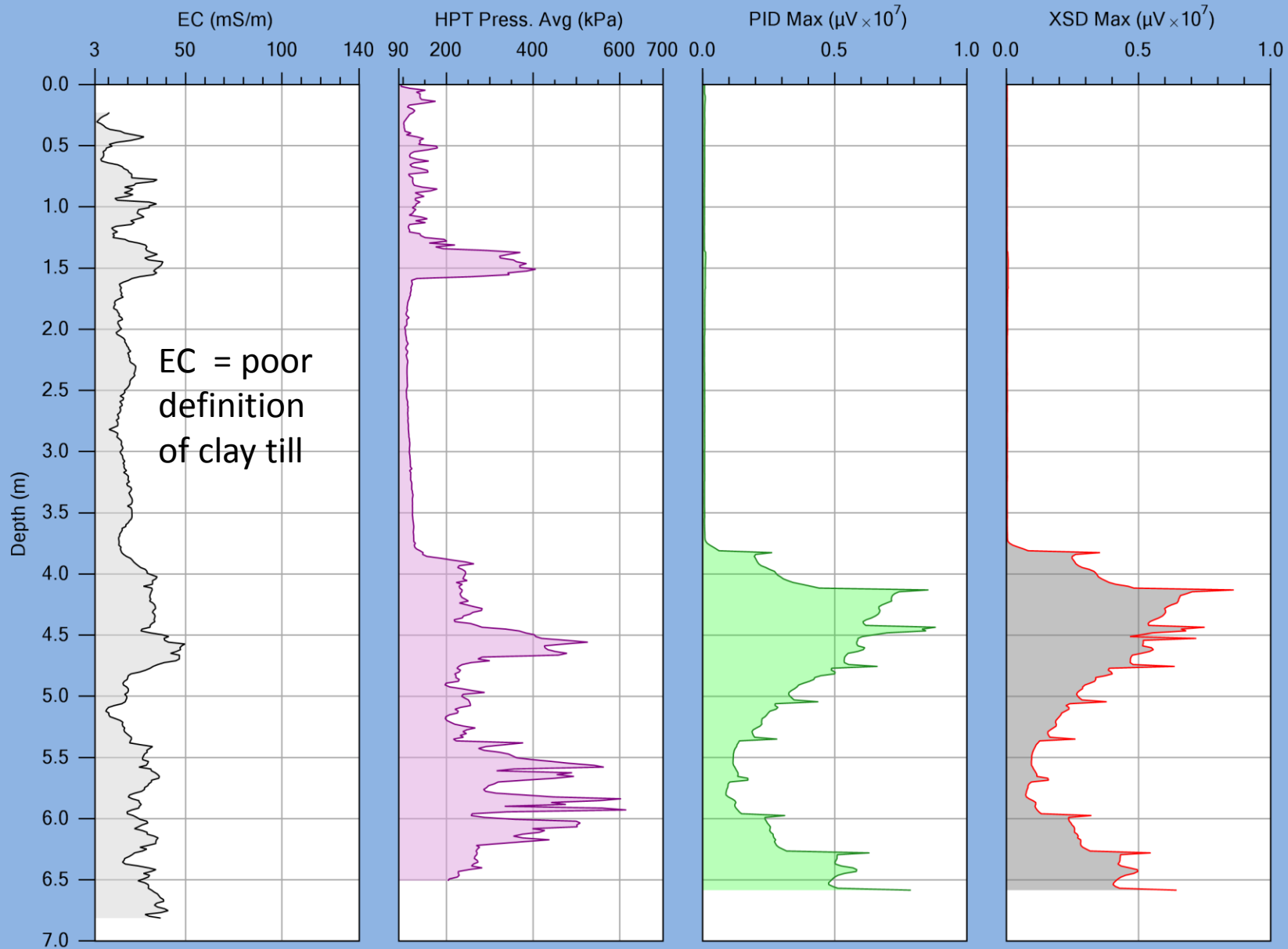
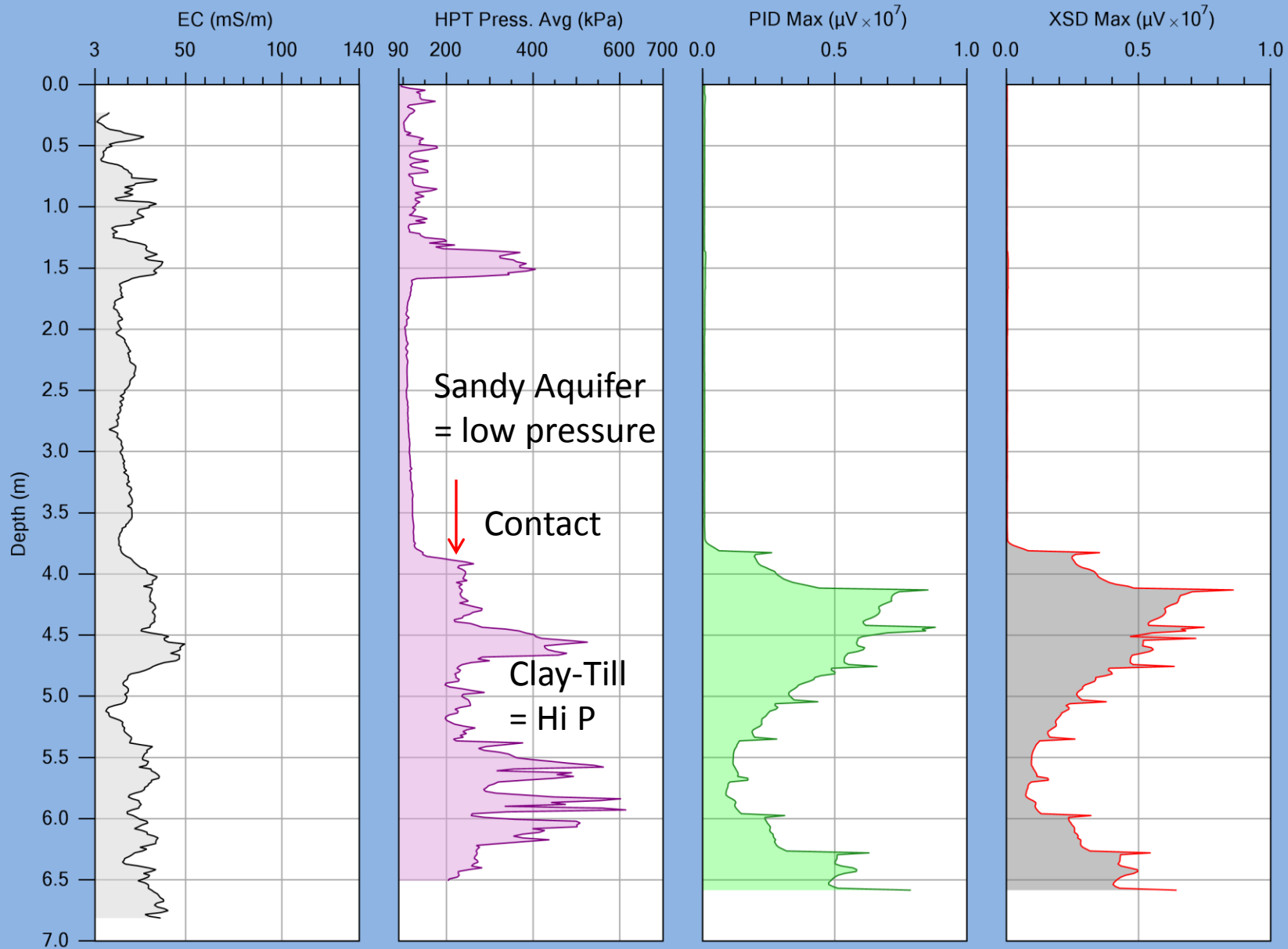
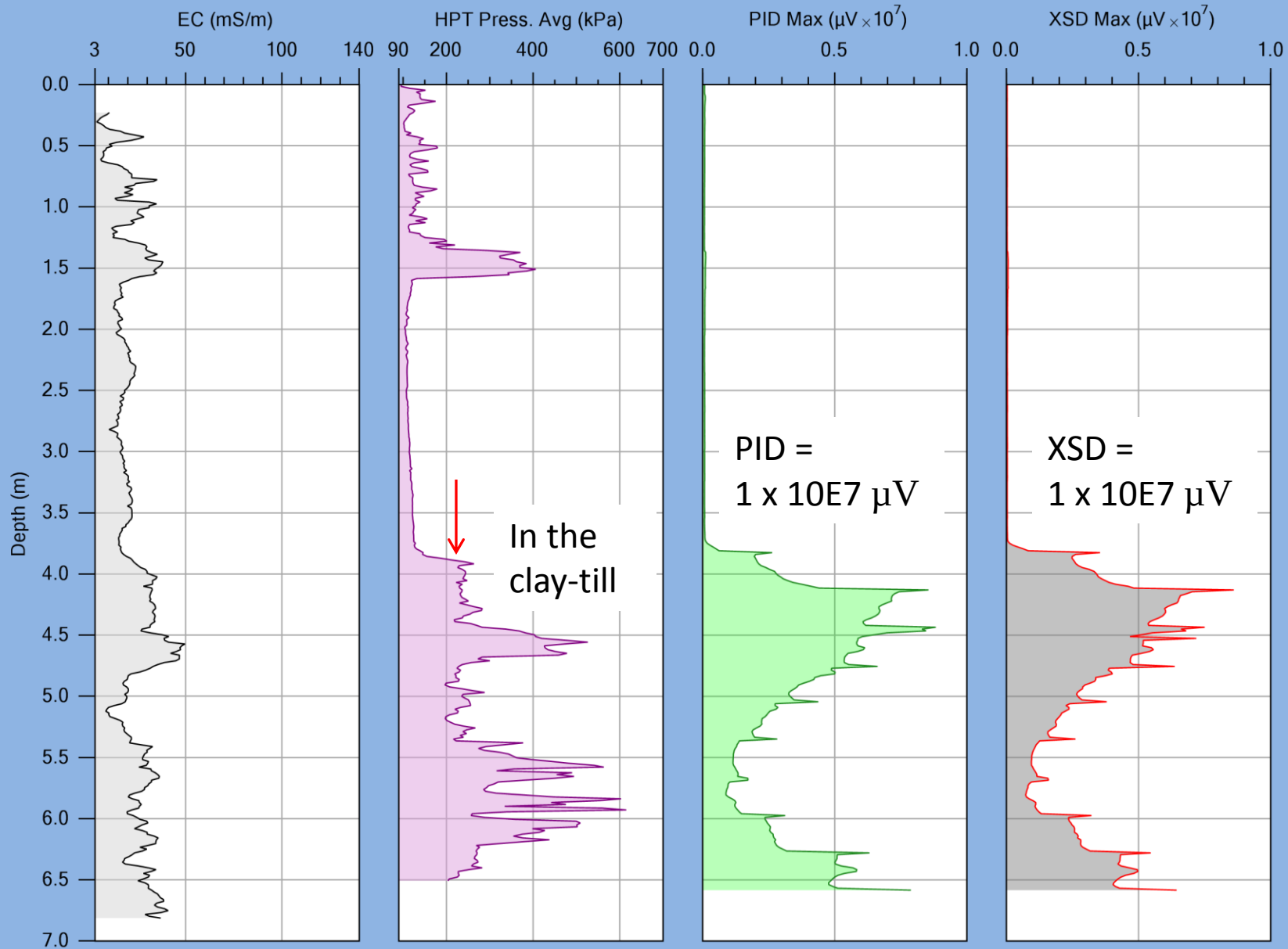
MiHpt Log at SK12 Location



MiHpt Log at SK12 Location



MiHpt Log at SK12 Location



Skuldelev : Cross Section

MiHpt Log **X**

Cross section Line - - - - -

GW Plume & Hot Spot

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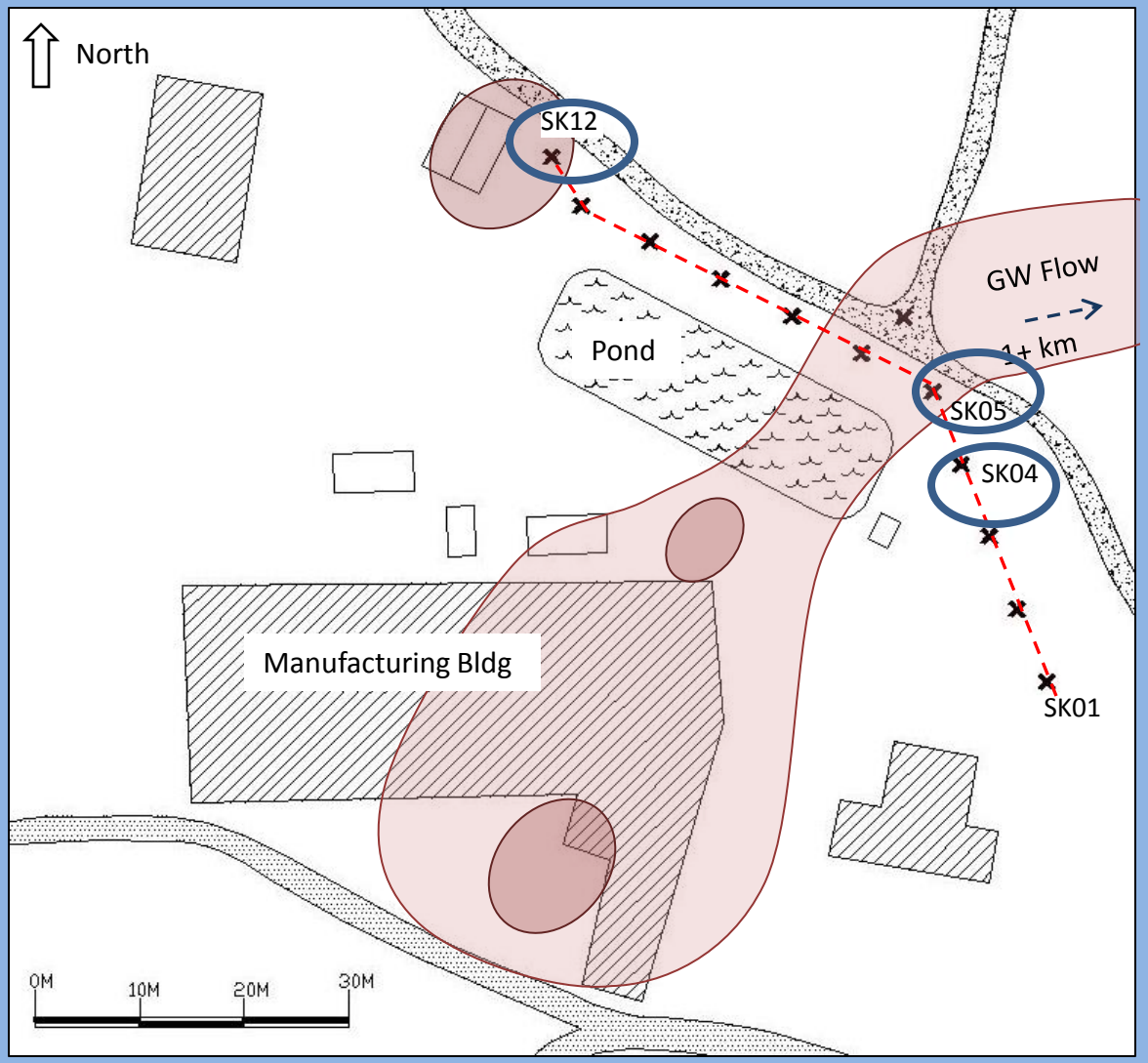

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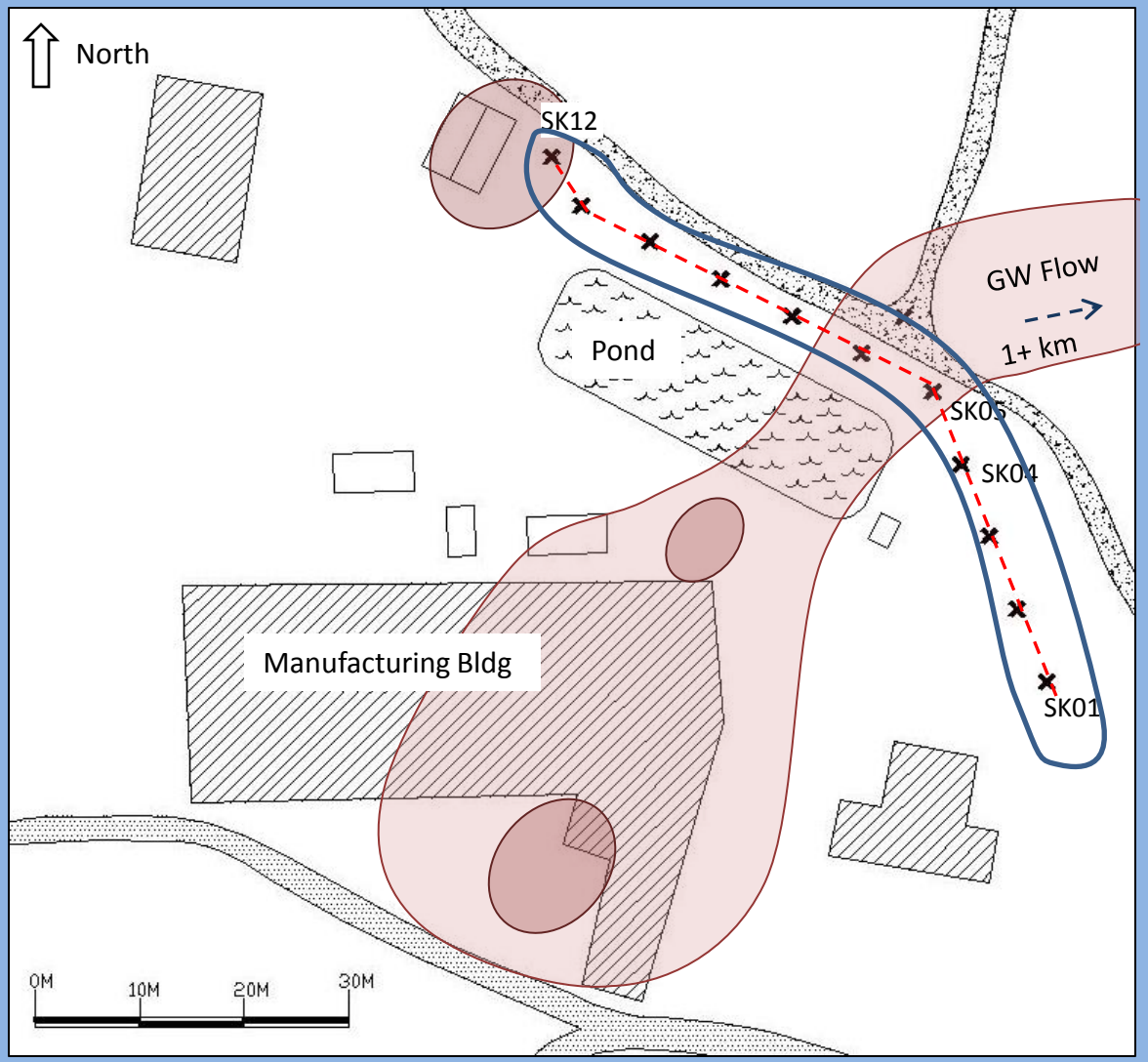

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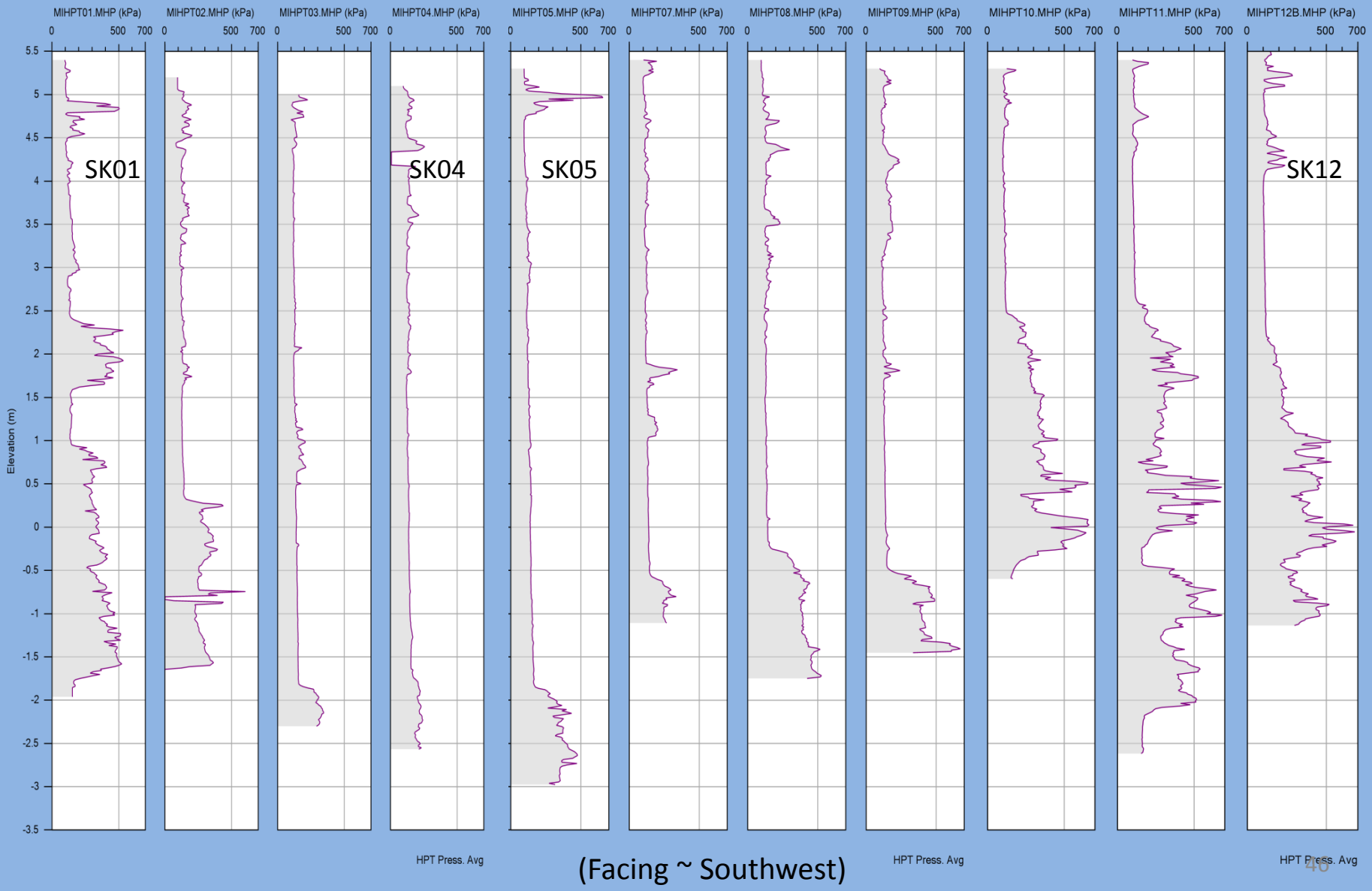
Skuldelev HPT Pressure X-Section

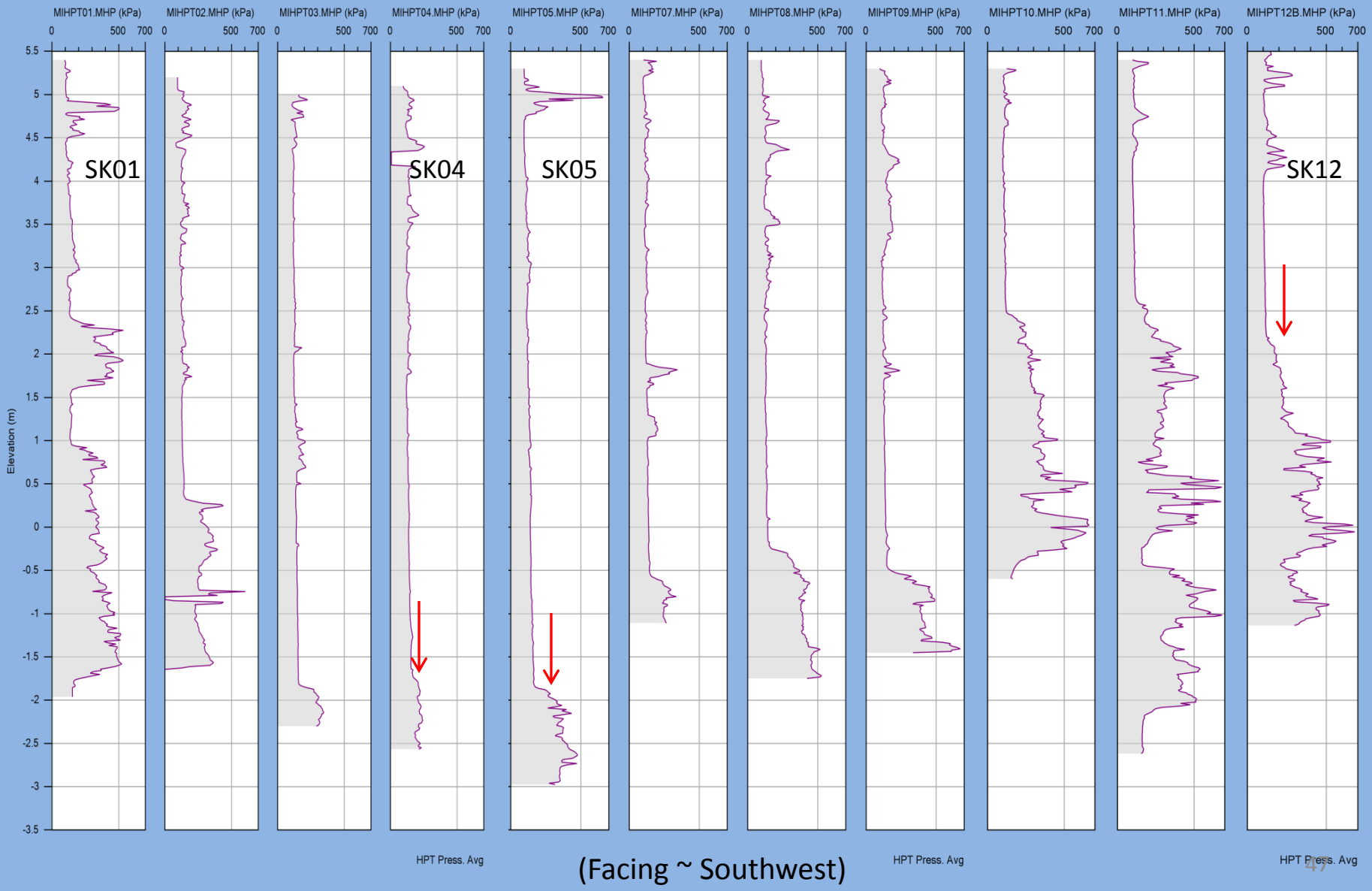
East (Elevation Corrected) West



(Facing ~ Southwest)

Skuldelev HPT Pressure X-Section

East (Elevation Corrected) West



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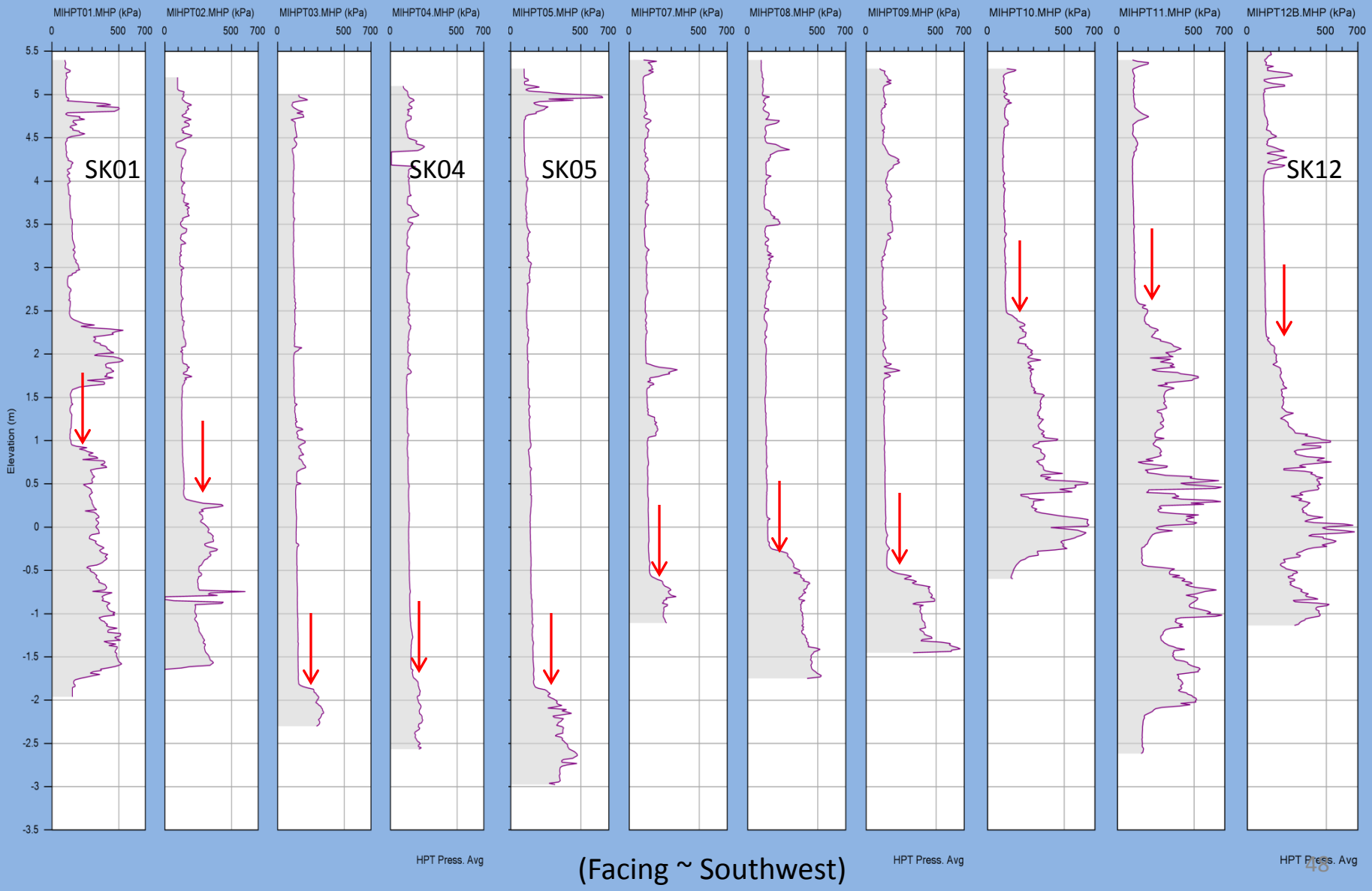

(Facing ~ Southwest)

Skuldelev HPT Pressure X-Section

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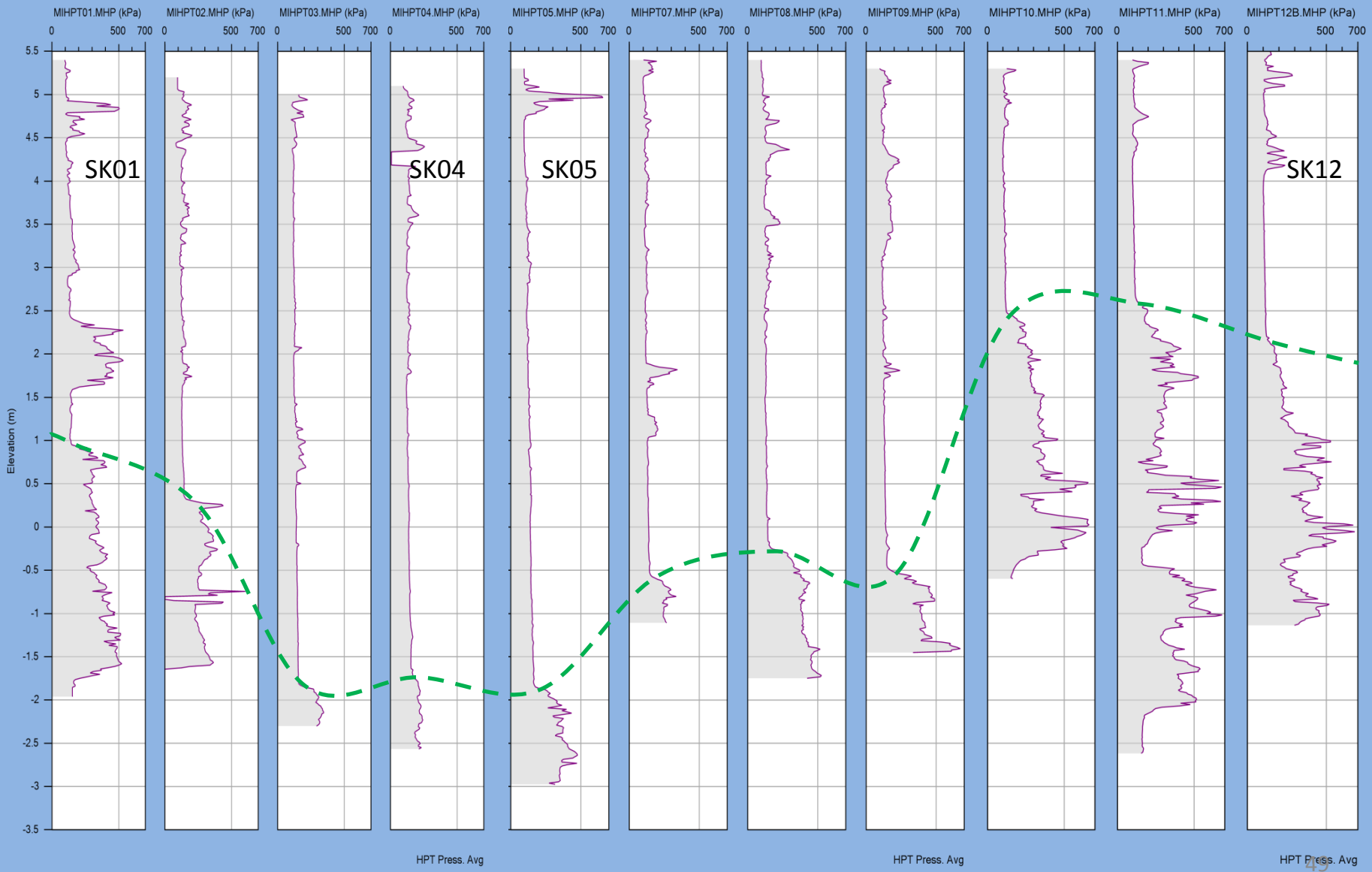
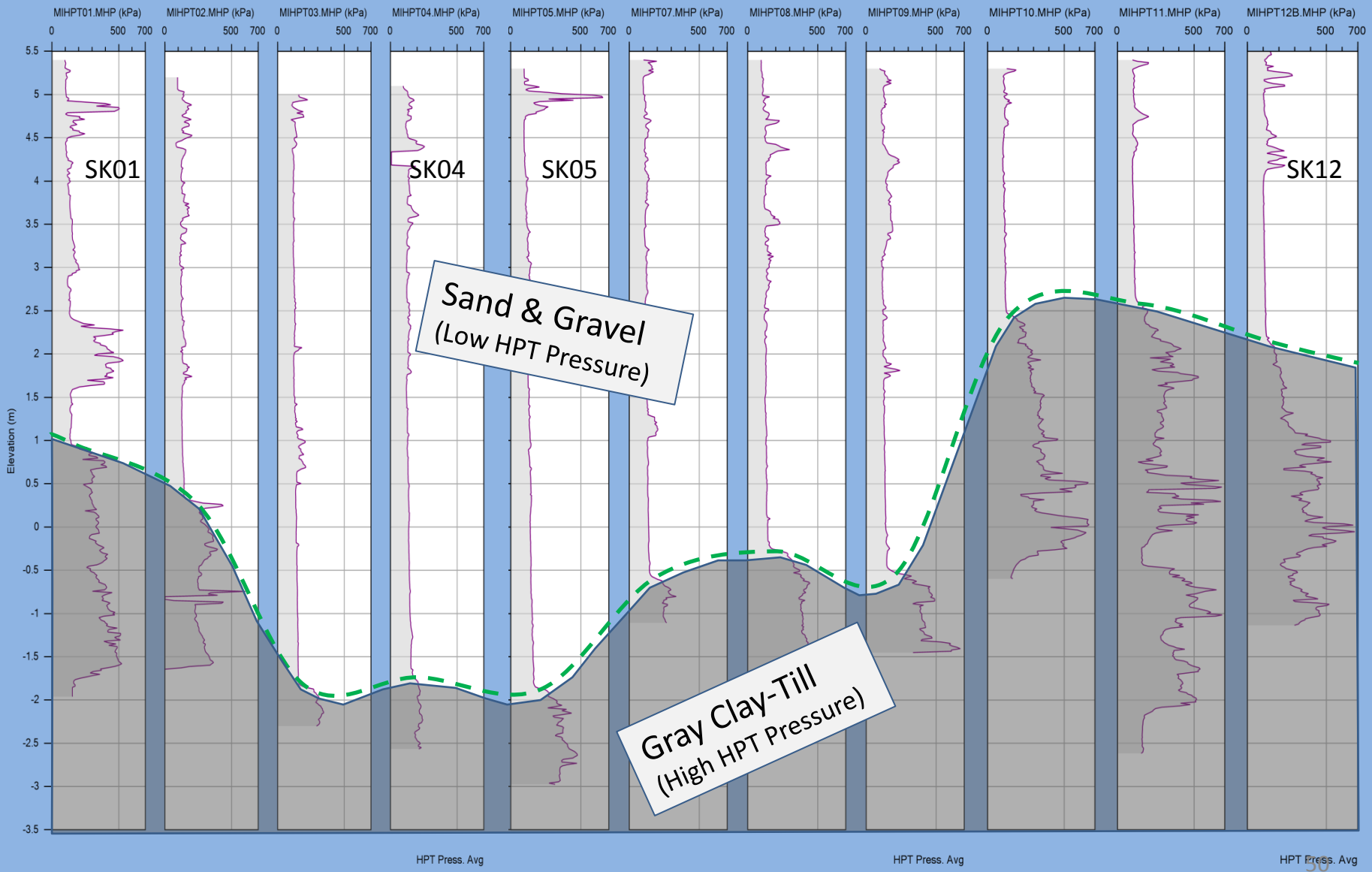


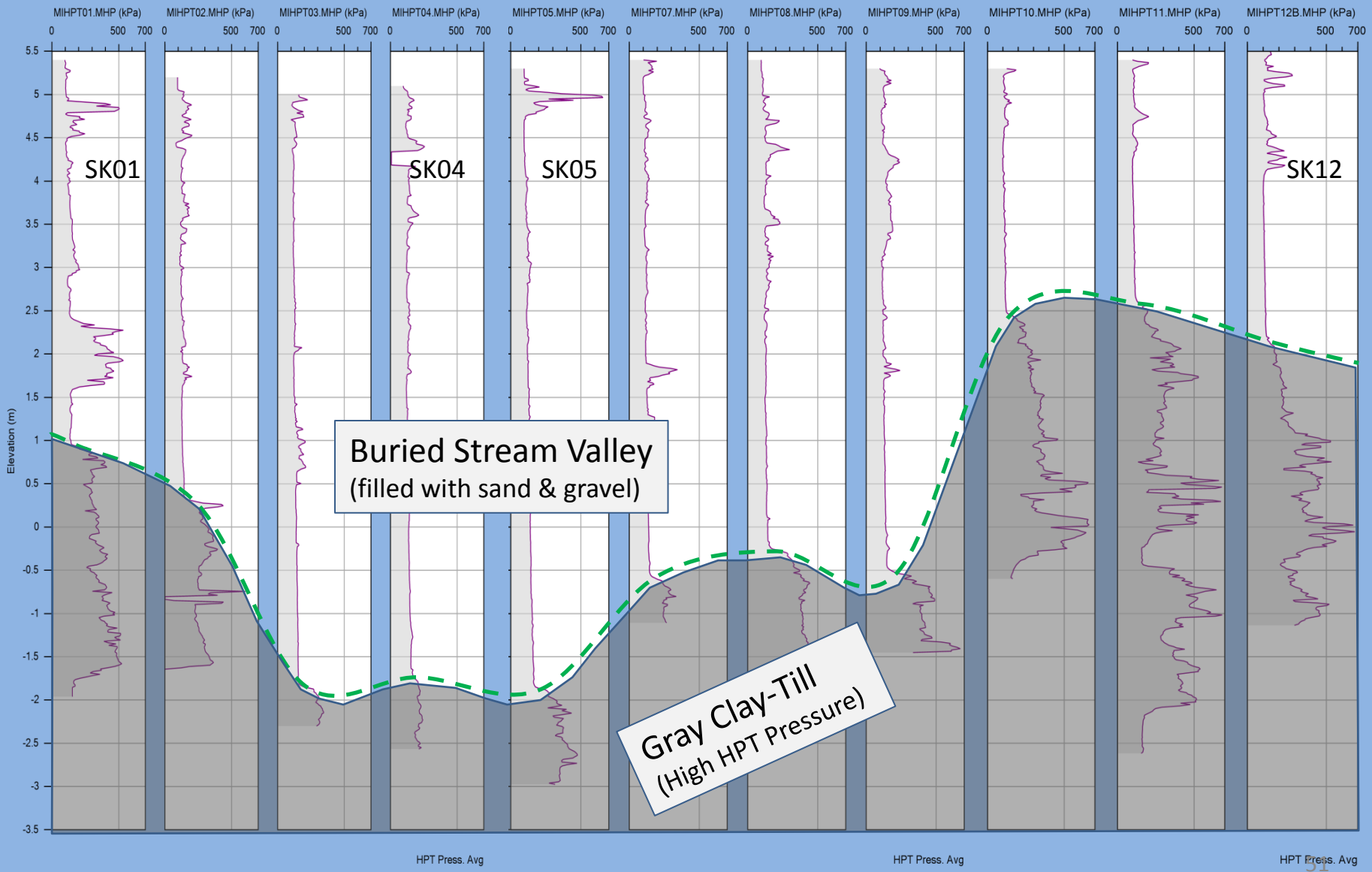
Skuldelev HPT Pressure X-Section

East West



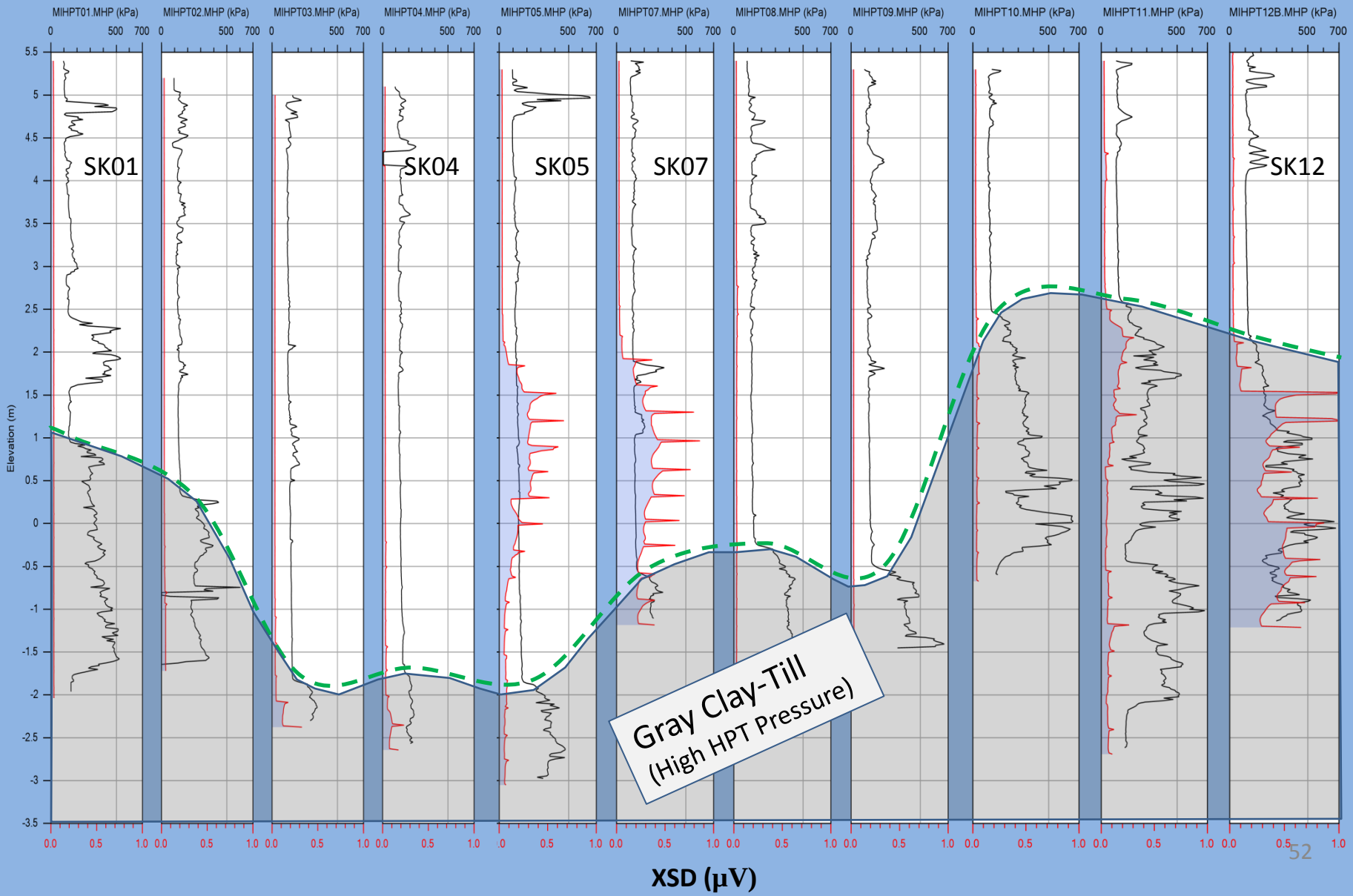
Skuldelev HPT Pressure X-Section = hydrogeologic model = CSM

East West



Skuldelev HPT Pressure and XSD Cross Section

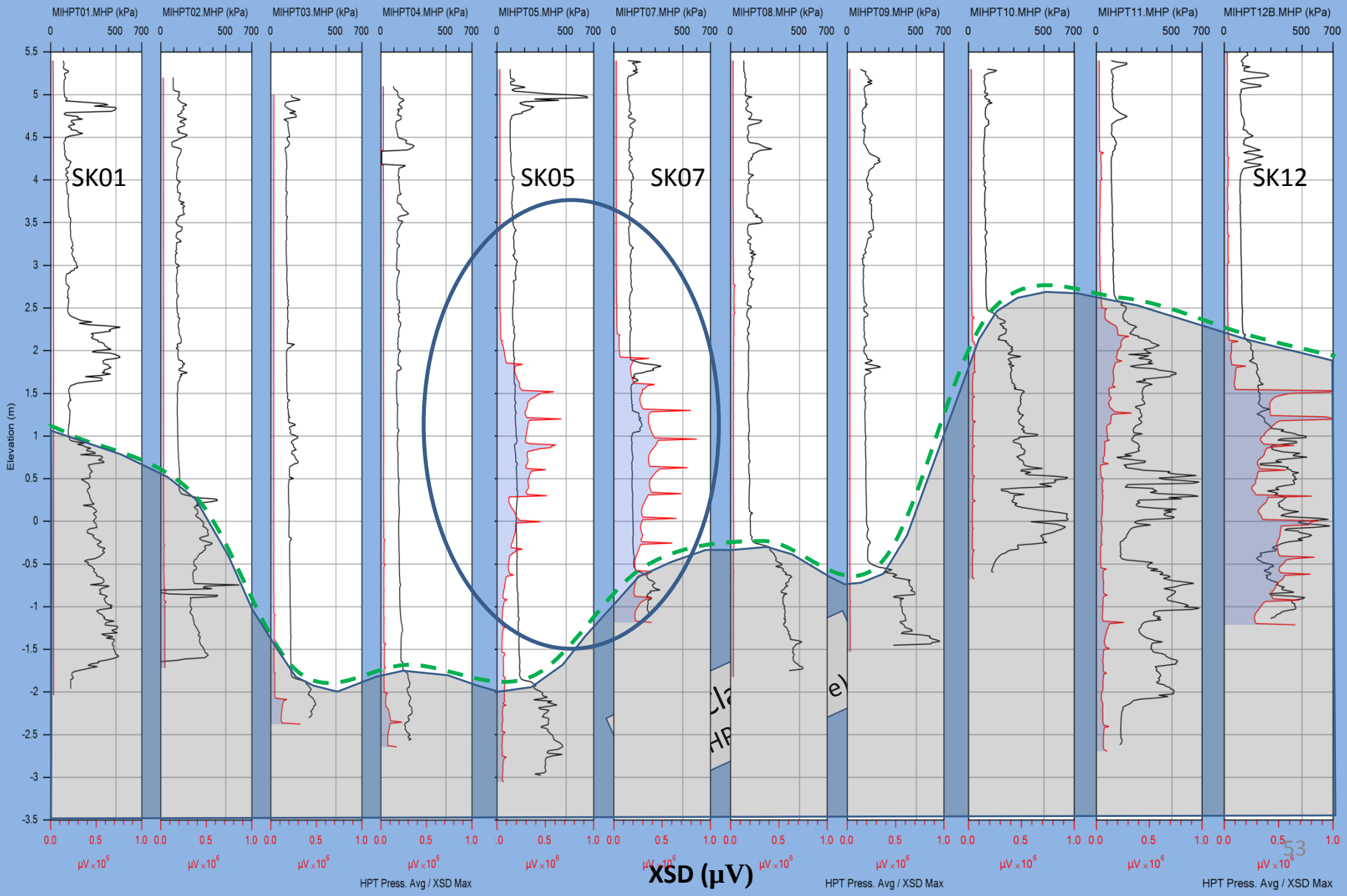
East West



Skuldelev HPT Pressure and XSD Cross Section

East

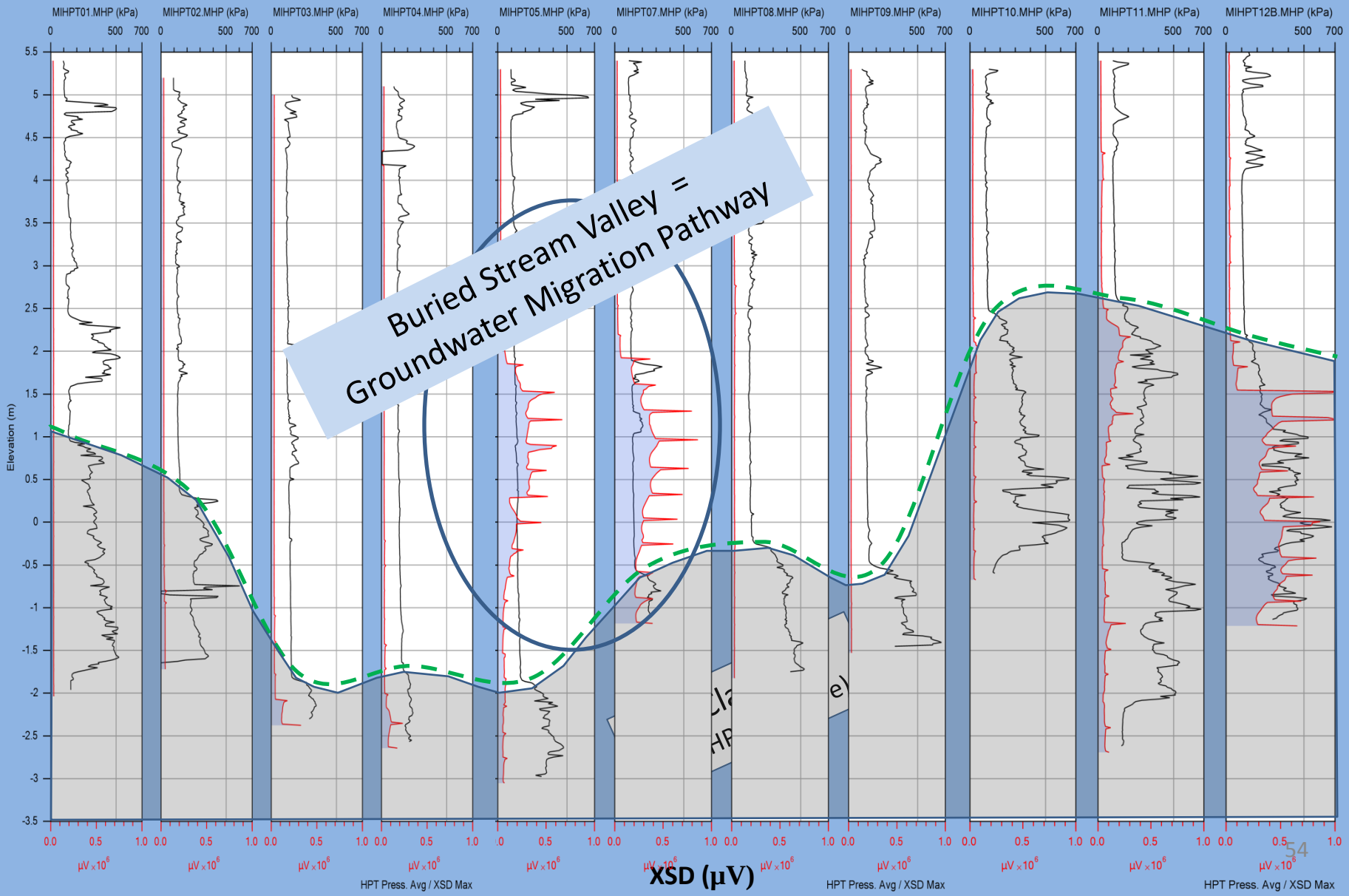
West



Skuldelev HPT Pressure and XSD Cross Section

East

West



Skuldelev HPT Pressure and XSD Cross Section

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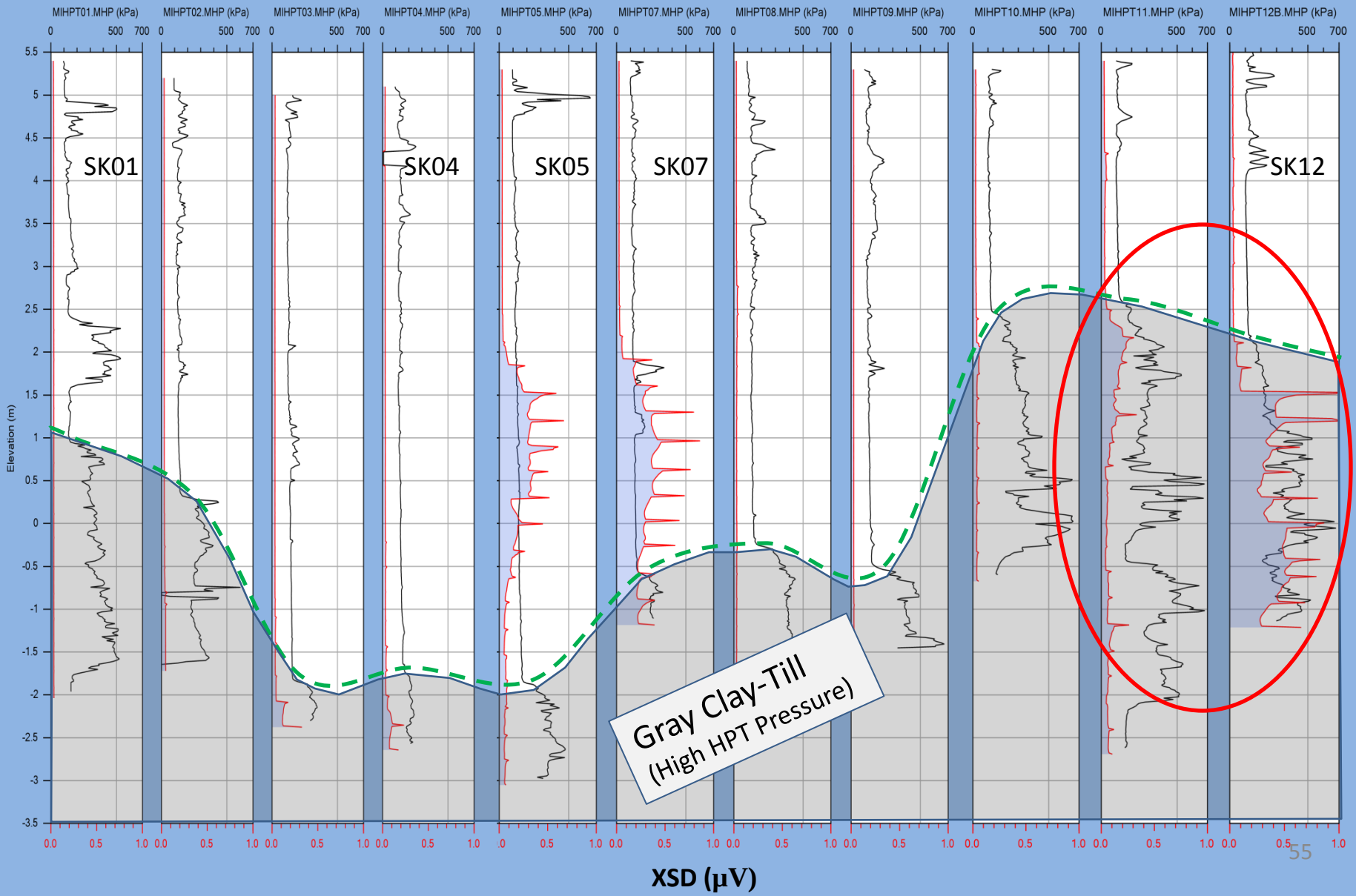

Skuldelev Location & Site Map

MiHpt Log **X**

Cross section Line - - - - -

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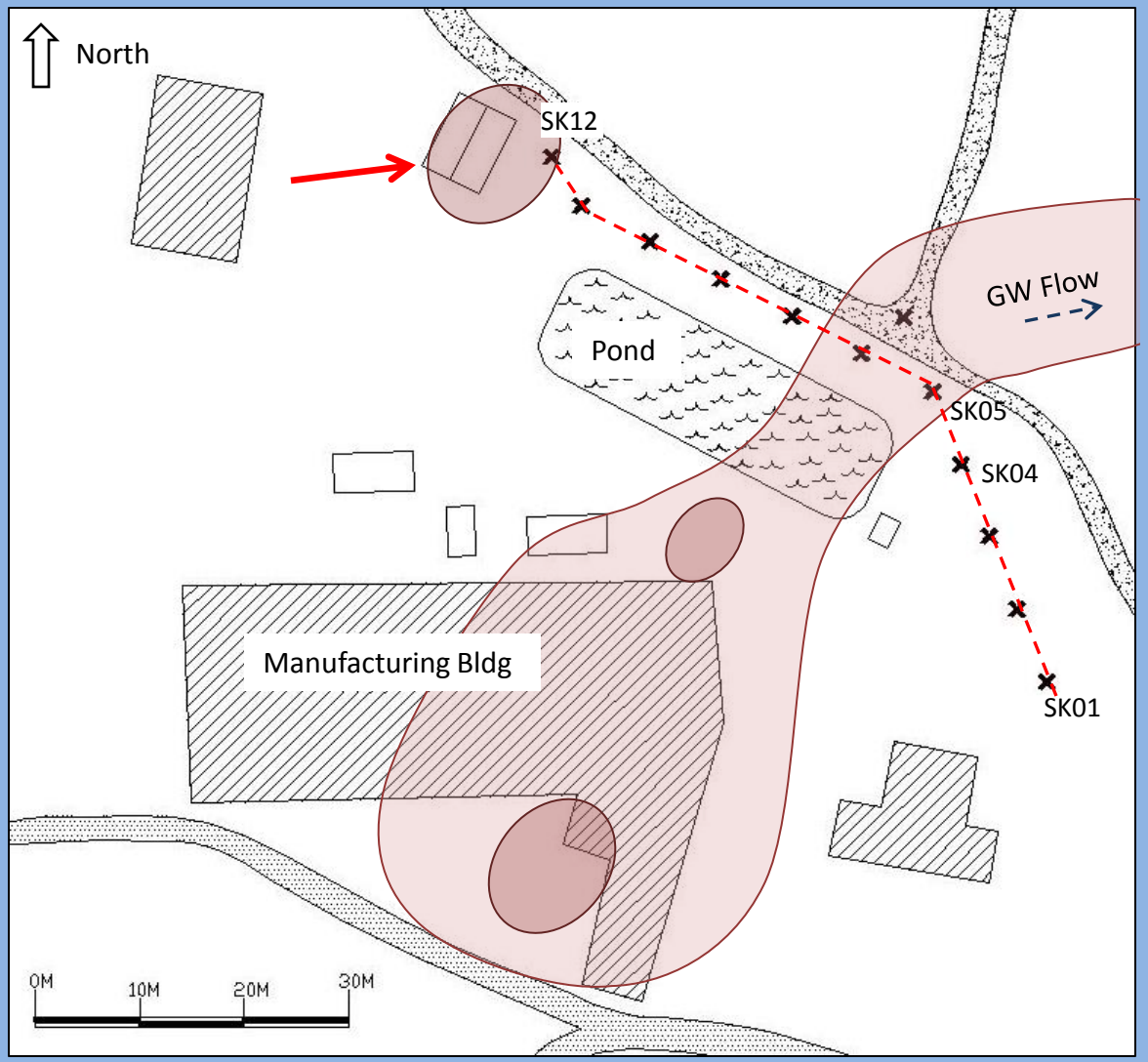
PCE, TCE, DCE & VC



Logs are spaced 8 m (~25ft) apart.

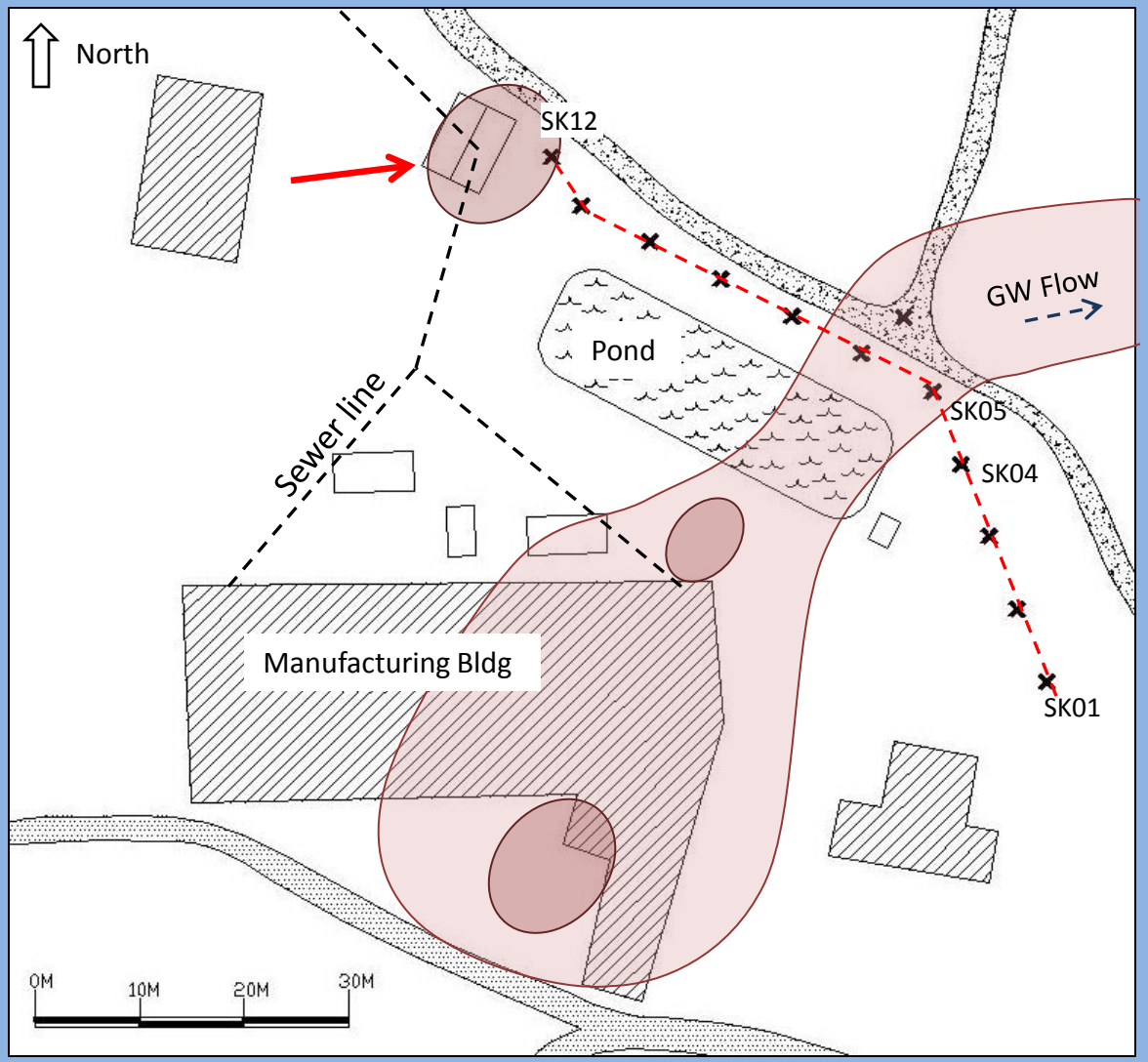
Skuldelev Location & Site Map

MiHpt Log **X**

Cross section Line

GW Plume & Hot Spot

PCE, TCE, DCE & VC

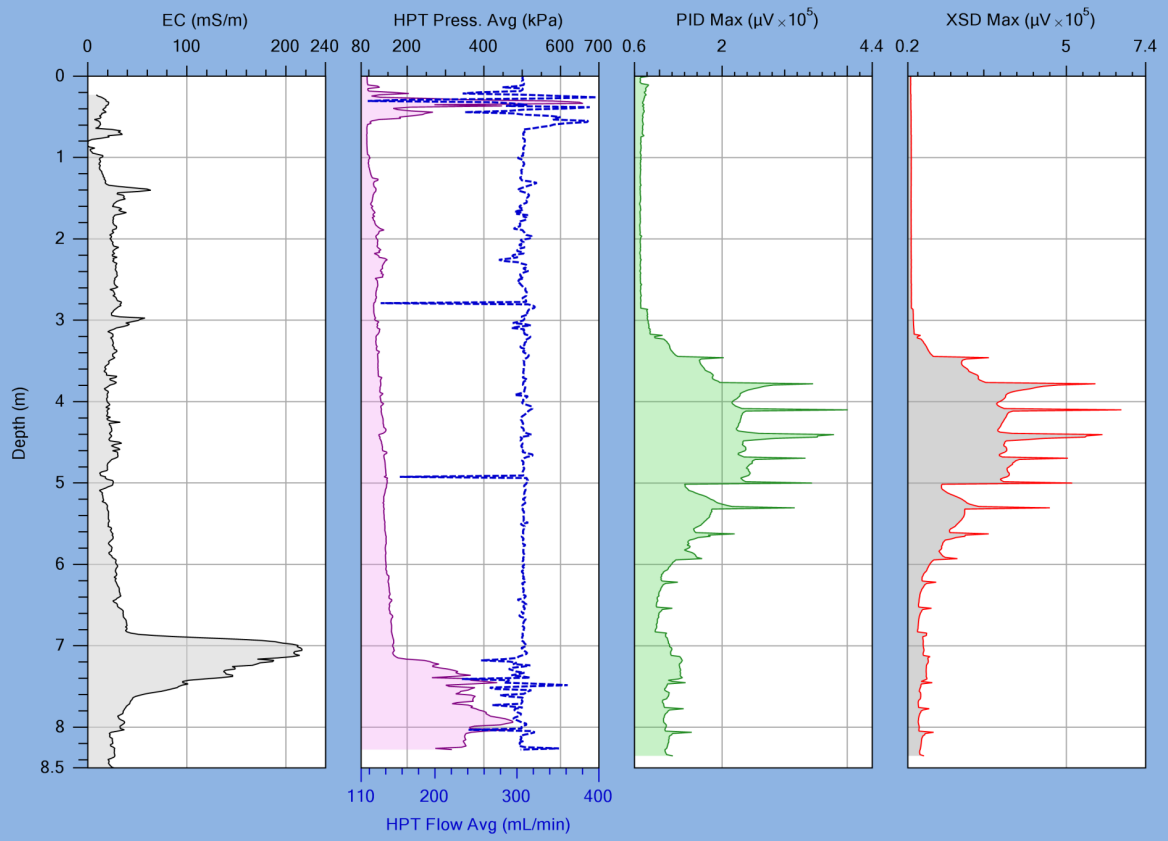


Logs are spaced 8 m (~25ft) apart.

MiHpt Summary

Combined MIP + HPT Probe Simultaneously Provides:

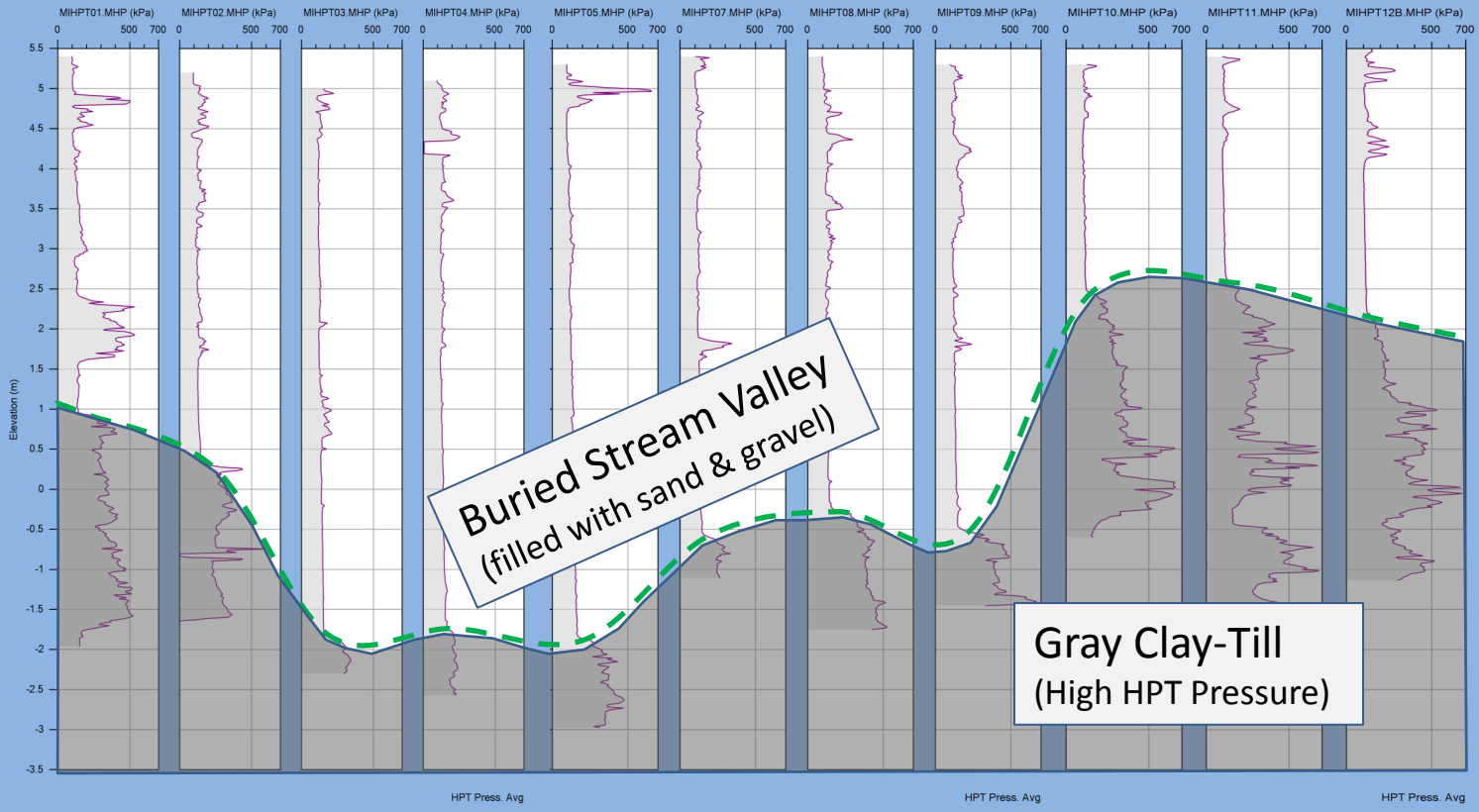
- MIP Detector Logs (where is it ? how much?)
- HPT Pressure Log (lithology, hydrostartigraphy)
- EC log



MiHpt Summary

Cross Sections with HPT Pressure Logs Provide:

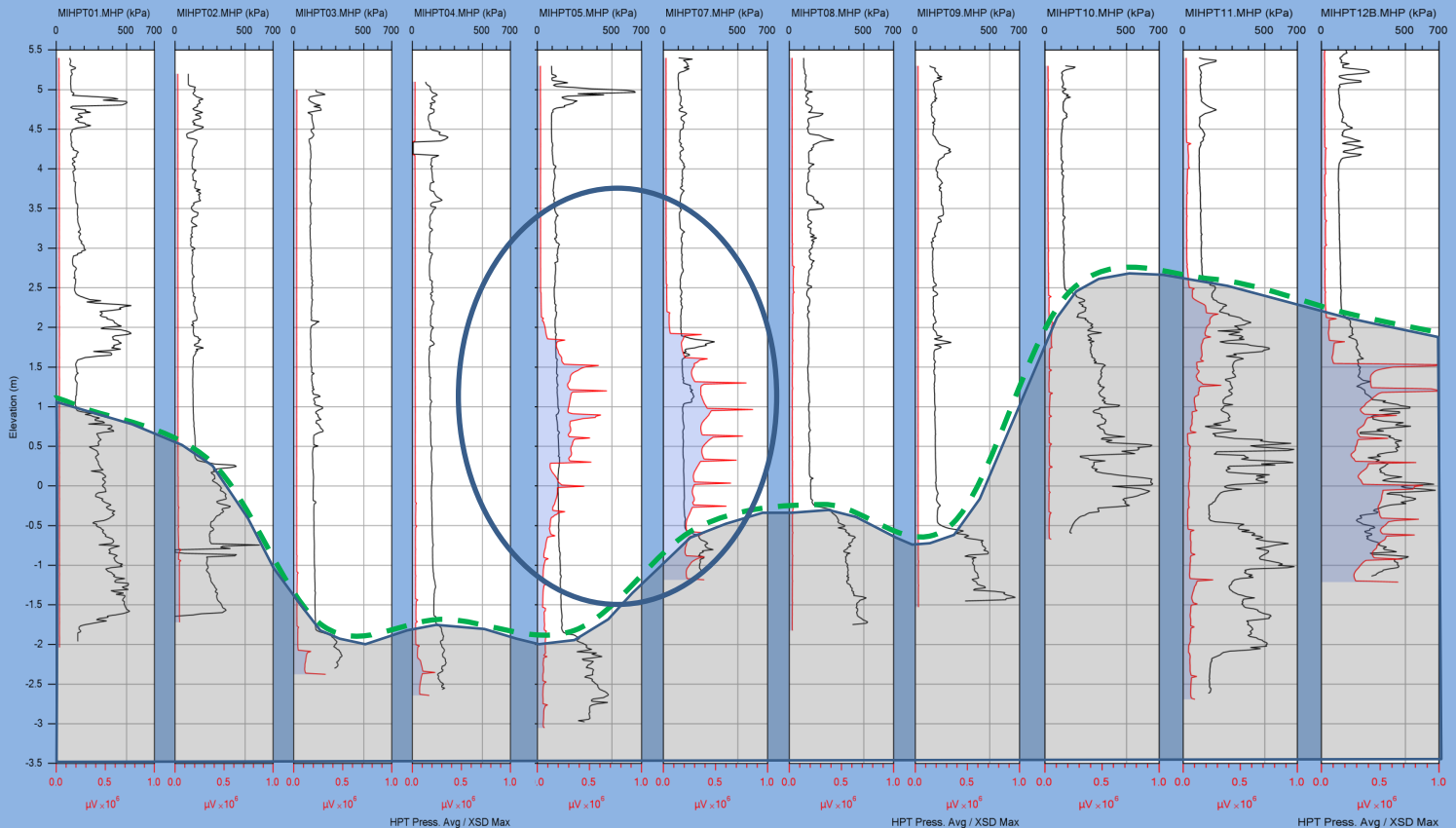
- Lithologic information
- Hydrogeologic model for the site
- Geologic cross sections



MiHpt Summary

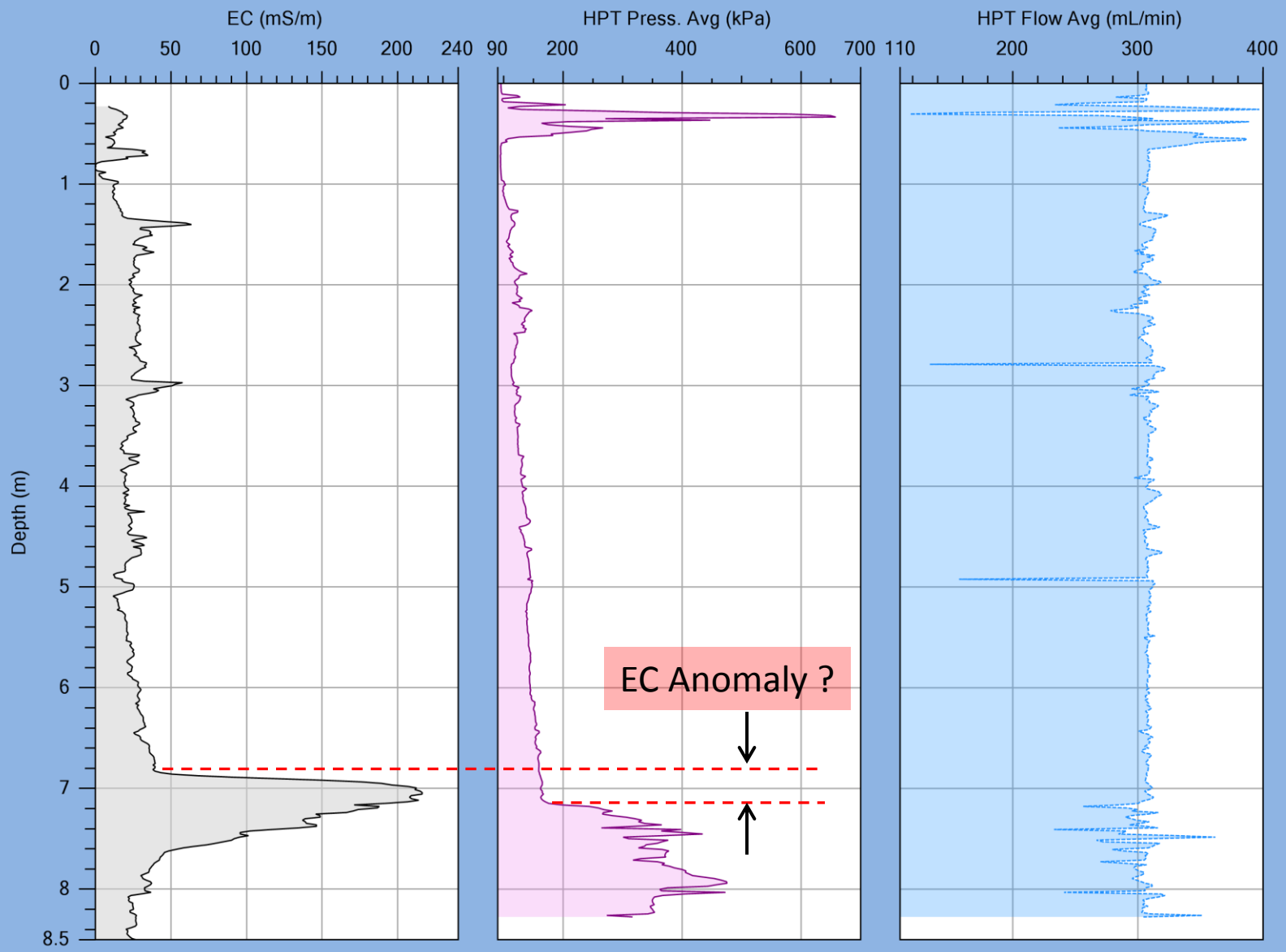
Cross Sections with MIP Detector Logs and HPT P Logs:

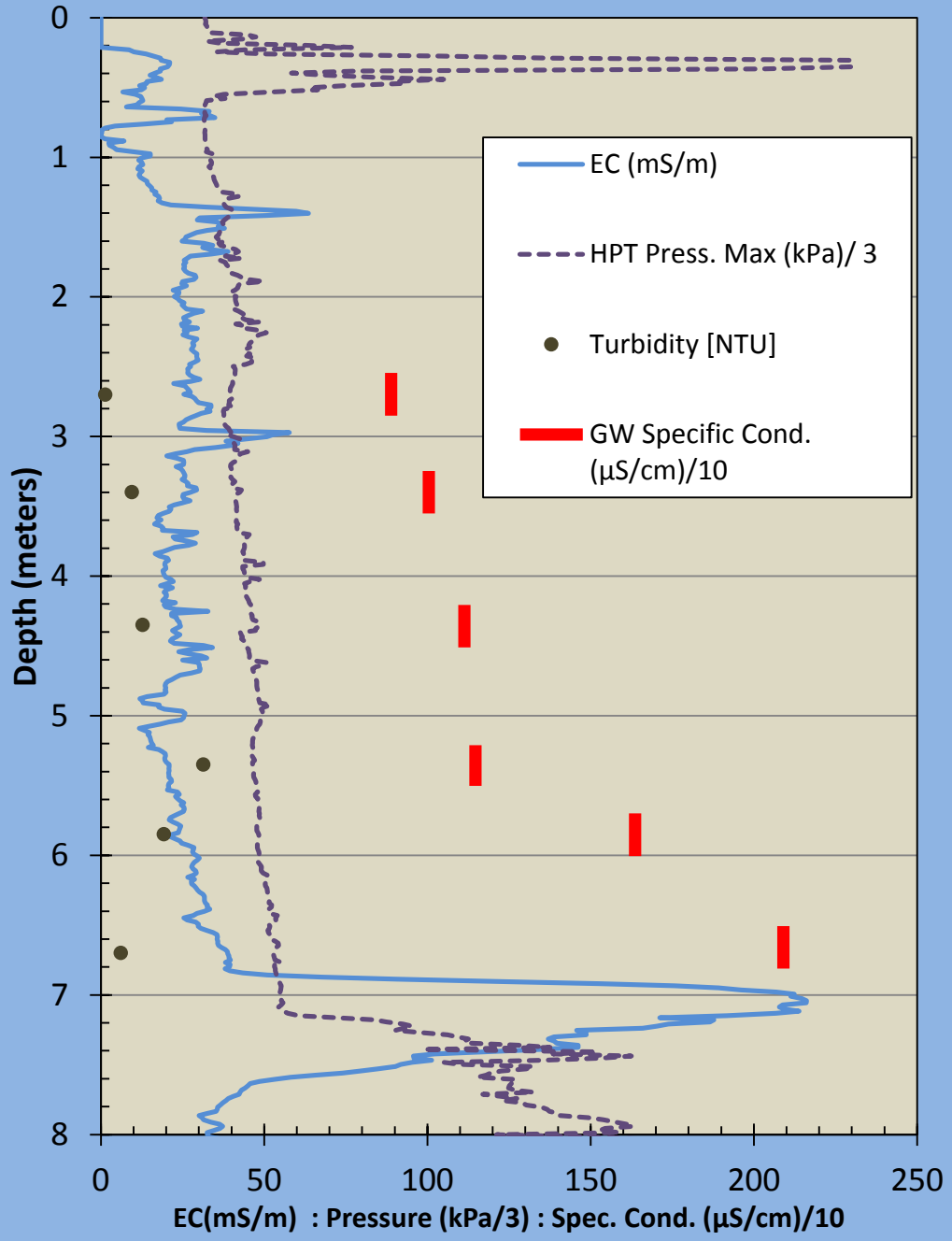
- Lithologic control on contaminant migration (migration pathways)
- Conceptual site model development



MiHpt … Q&A

Example HPT Log : Skuldelev SK05



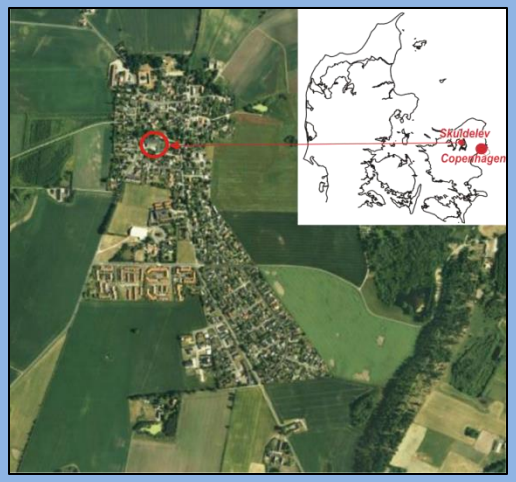


SK05 Location

EC & HPT Pressure

Groundwater specific conductance

Skuldelev Location & Site Map



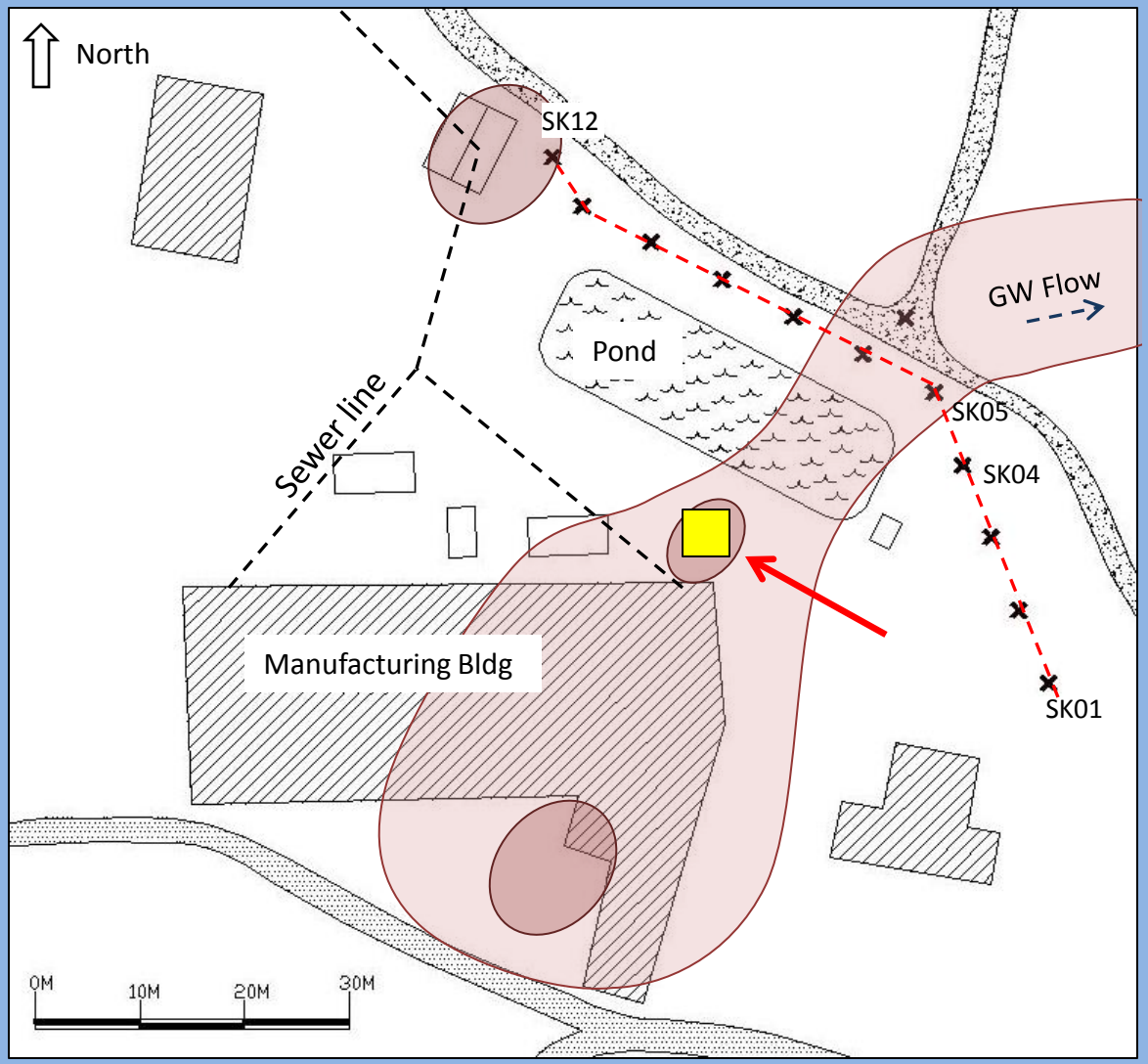
MiHpt Log **X**

Cross section Line

GW Plume & Hot Spot

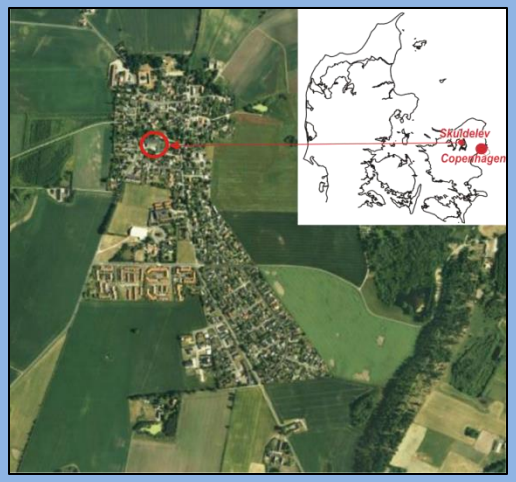
PCE, TCE, DCE & VC

Persulfate Injection



Logs are spaced 8 m (~25ft) apart.

Skuldelev Location & Site Map



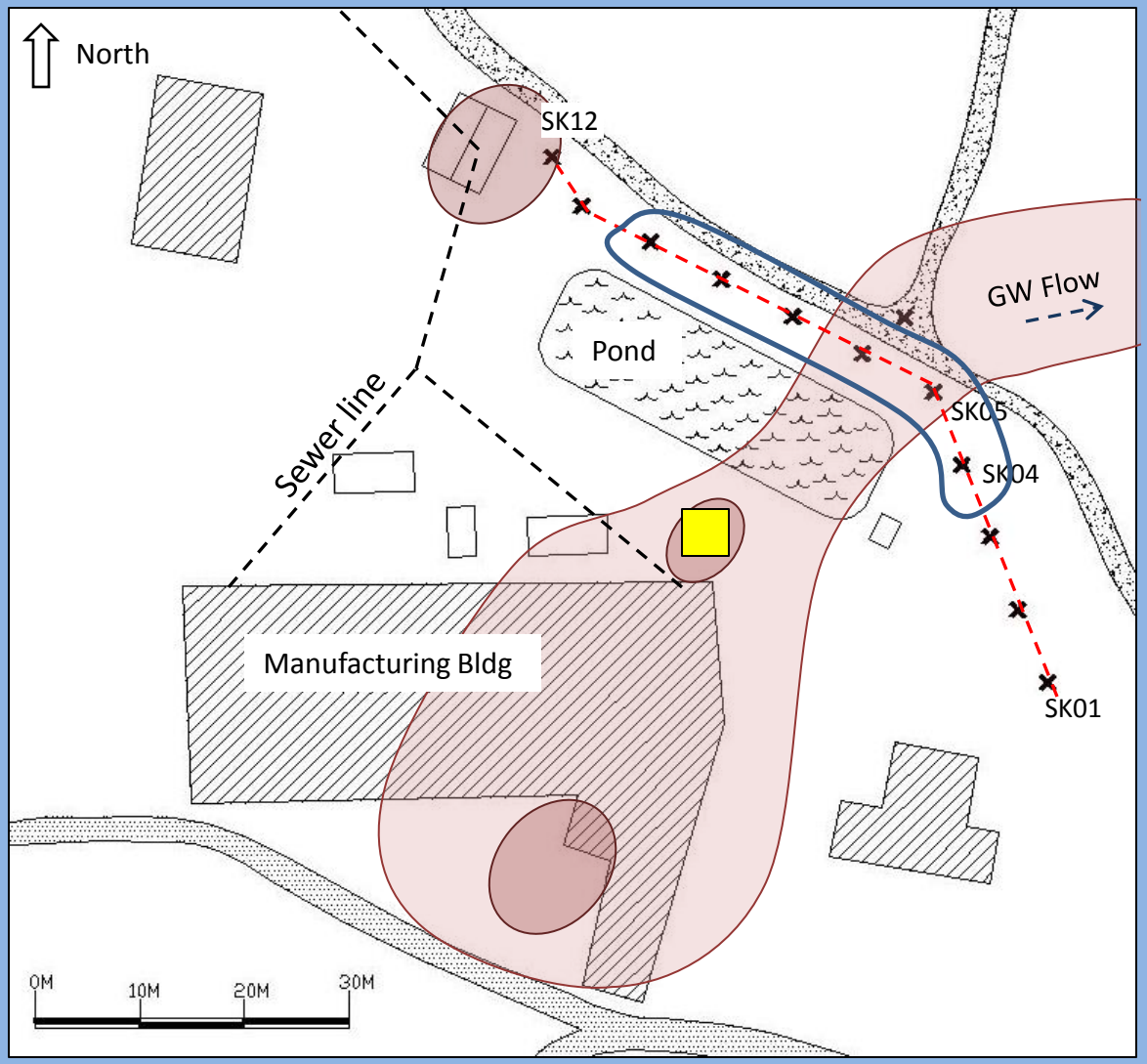
MiHpt Log **X**

Cross section Line - - - - -

GW Plume & Hot Spot

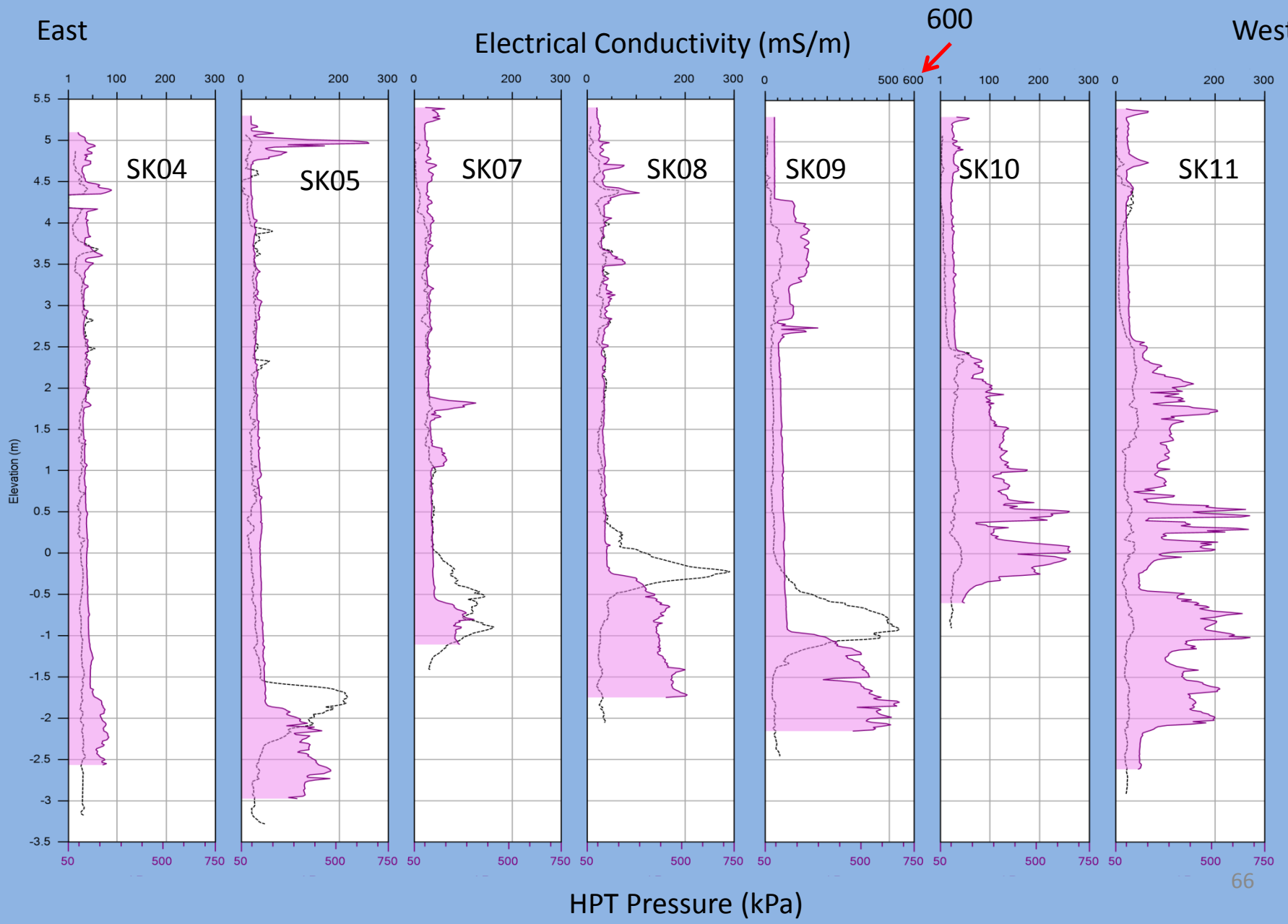
PCE, TCE, DCE & VC

Persulfate Injection

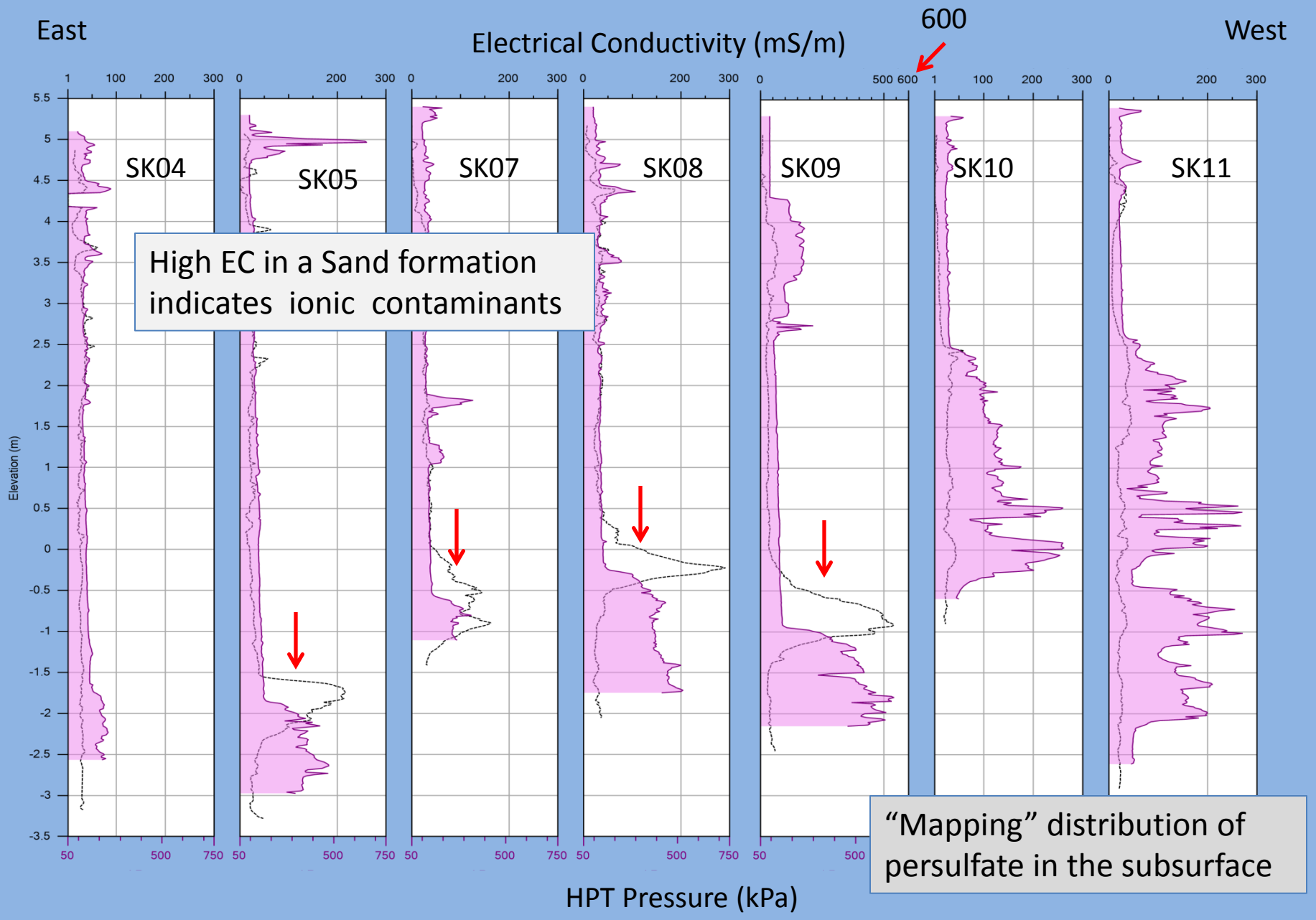


Logs are spaced 8 m (~25ft) apart.

Cross Section with HPT Pressure & EC

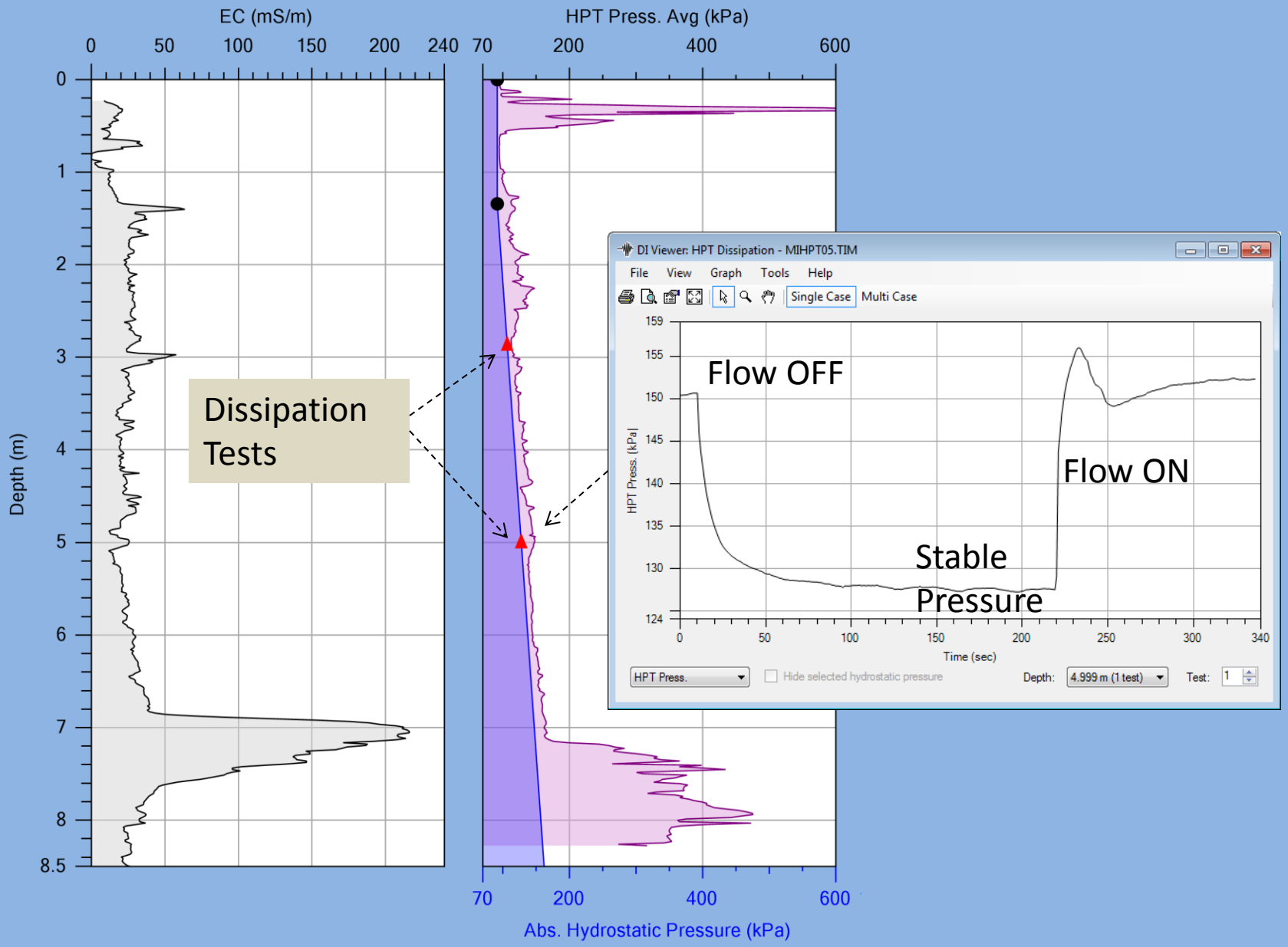


Cross Section with HPT Pressure & EC

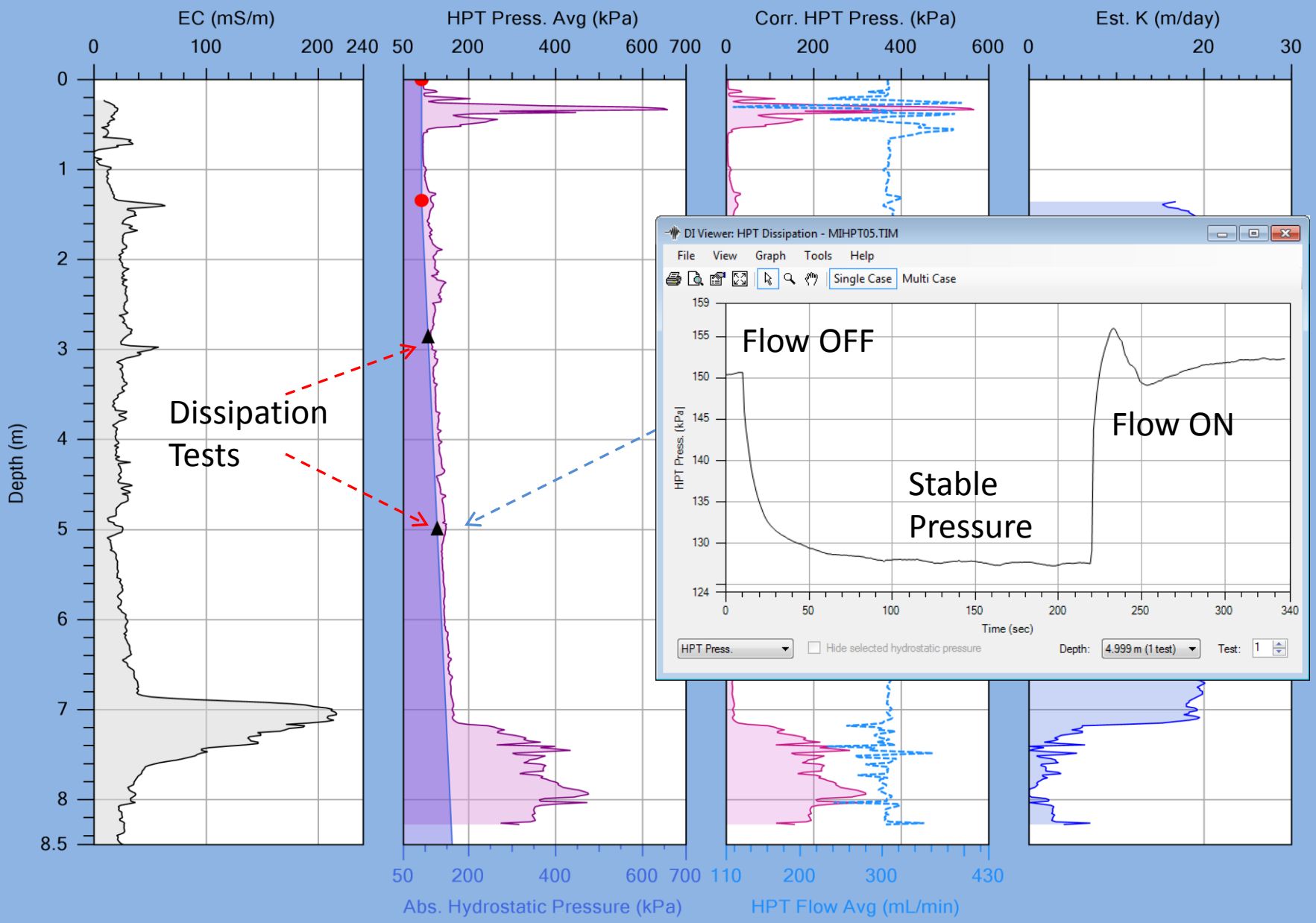


Estimating Hydraulic Conductivity (K) from HPT Pressure and Flow Logs

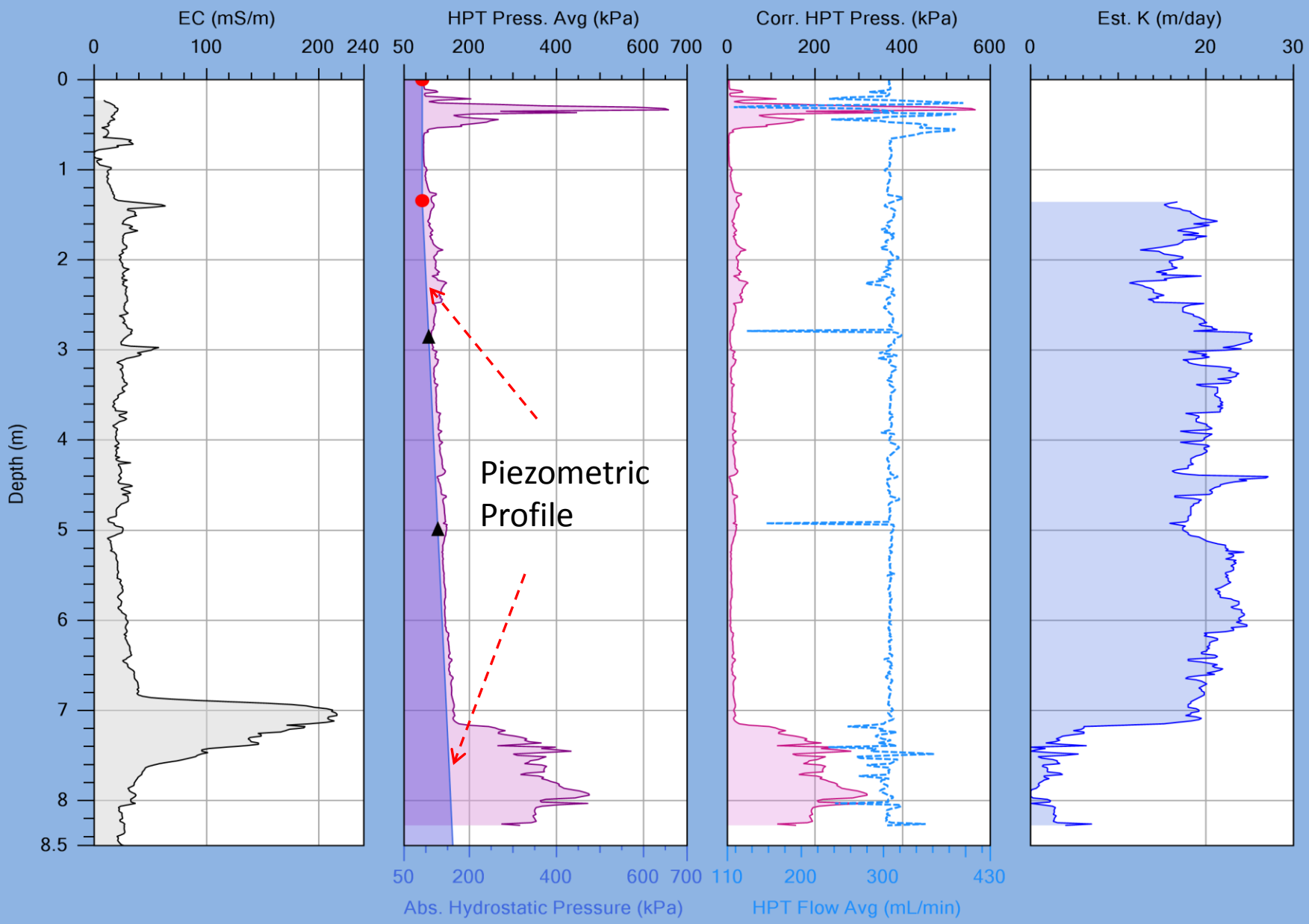
HPT Dissipation Test



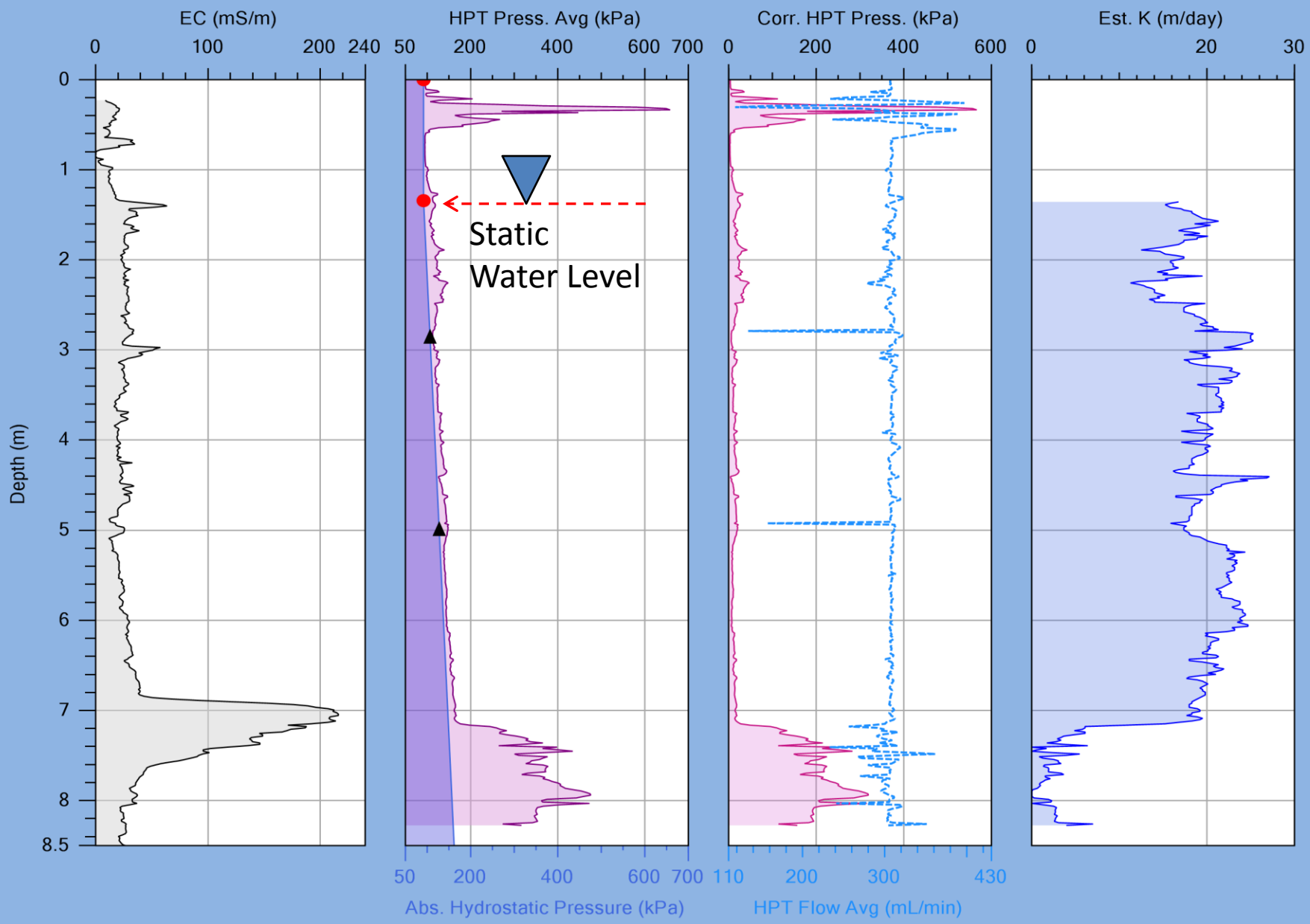
HPT and Hydrostatic > Corrected Pressure > Est K



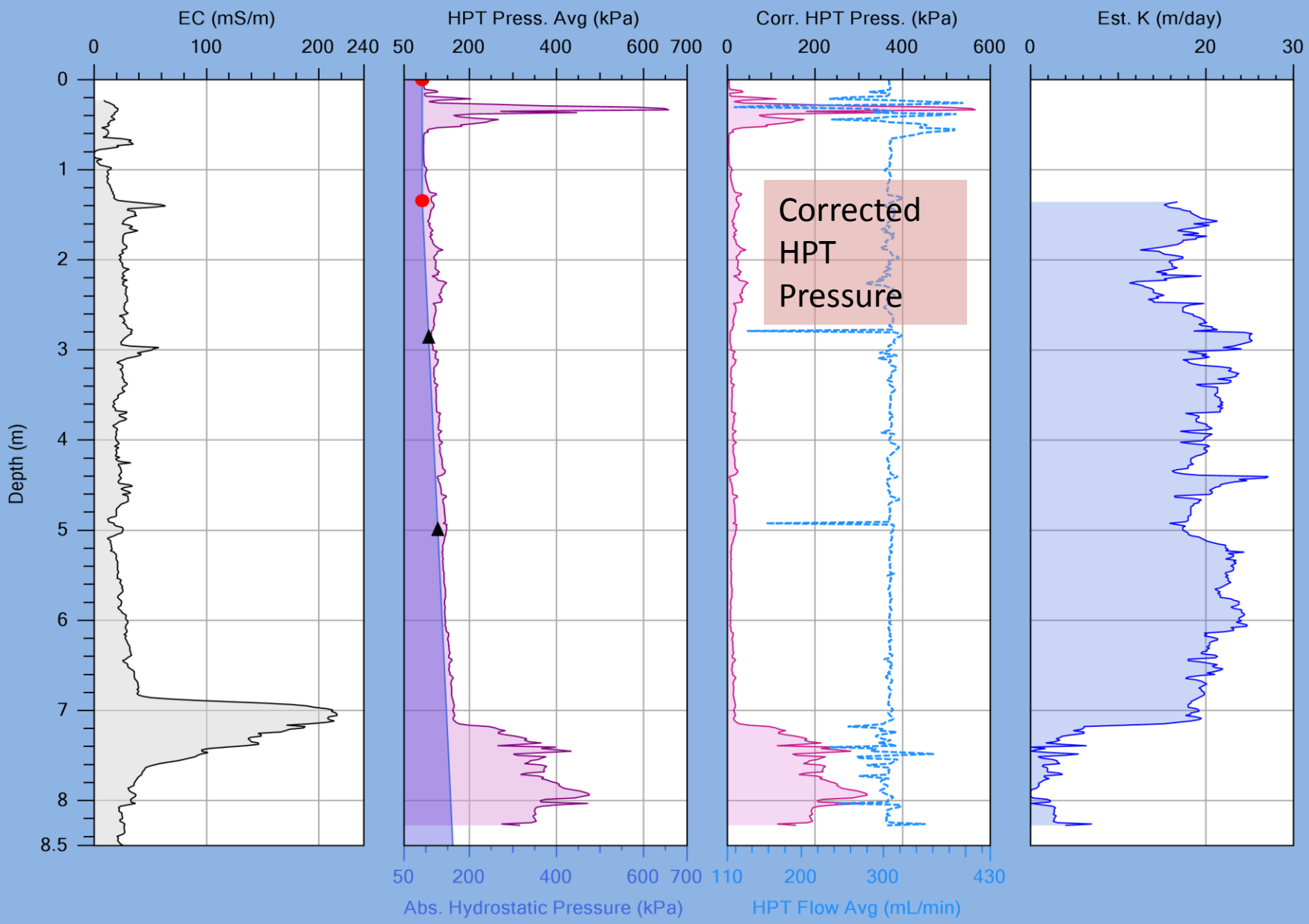
HPT and Hydrostatic > Corrected Pressure > Est K



HPT and Piezometric P > Corrected P > Est K



HPT and Piezometric P > Corrected P > Est K



HPT and Piezometric P > Corrected P > Est K